UNITED STATES DEPARTMENT OF COMMERCE
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NATIONAL MARINE FISHERIES SERVICE
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JUN 29 2007 F/SER32:KPB

Mr. Joseph Christopher
Regional Supervisor
Minerals Management Service
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Dear Mr. Christopher:

This constitutes the National Marine Fisheries Service's (NMFS) biological opinion (opinion) based on our review of the Minerals Management Service's (MMS) request for formal Endangered Species Act (ESA) section 7 consultation on the effects of the Five-Year Outer Continental Shelf Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico. The biological opinion concludes that the five-year leasing program and its associated actions are not likely to jeopardize the continued existence of threatened or endangered species under the jurisdiction of NMFS or destroy or adversely modify designated critical habitat. However, NMFS anticipates incidental take of sea turtle species and has issued an Incidental Take Statement (ITS) pursuant to section 7 of the ESA. This ITS contains reasonable and prudent measures with implementing terms and conditions to help minimize this take.

We look forward to cooperation with you on a pile driving study and workshop, and our continued cooperation to ensure the conservation of our threatened and endangered marine species and designated critical habitat. We have enclosed other statutory requirements that may apply to this action, as well as additional information on NMFS' Public Consultation Tracking System to allow you to track the status of ESA consultations. If you have any questions, please contact Kyle Baker, fishery biologist, at (727) 824-5312, or by e-mail at kyle.baker@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosures

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Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	Department of the Interior, Minerals Management Service
Activity:	Gulf of Mexico Oil and Gas Activities: Five-Year Leasing Plan for Western and Central Planning Areas 2007-2012
Consulting Agency:	National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division
Approved by:	Roy E. Crabtree, Ph.D., Regional Administrator National Marine Fisheries Service, Southeast Regional Office St. Petersburg, Florida
Date Issued:	6/29/07

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1 INTRODUCTION

The Outer Continental Shelf Lands Act (OCSLA) is the primary Act giving MMS its regulatory authority to establish policies and procedures for managing the oil and natural gas resources of the Outer Continental Shelf (OCS). The Energy Policy Act of 2005 expanded and further defined the MMS role in energy development. Enacted on August 8, 2005, the Energy Policy Act amended Section 8 of the OCSLA to authorize the Department of the Interior (DOI) to grant leases, easements, or rights-of-way on the OCS for the development and support of energy resources from sources other than oil and gas and to allow for alternate uses of existing facilities on the OCS. The Energy Policy Act grants MMS new responsibilities over Federal offshore renewable energy and related uses of the OCS. Although no projects are planned at this time, MMS is evaluating the potential of renewable energy resources on the OCS.

The OCSLA requires DOI to prepare a five-year program that specifies the size, timing and location of areas to be assessed for Federal offshore natural gas and oil leasing. It is the role of DOI to ensure that the U.S. government receives fair market value for acreage made available for leasing and that any oil and gas activities conserve resources, operate safely, and take maximum steps to protect the environment. The last five-year program expires on June 30, 2007. MMS has formulated the next five-year program for 2007-2012, including all leaseable U.S. Federal waters in the Central Planning Area (CPA) and the Western Planning Area (WPA). The Gulf of Mexico (GOM) Region of MMS has developed one EIS and a biological assessment for the eleven lease sales scheduled in the GOM under the 2007-2012 five-year program.

Recent Lease Sale Consultation History

The MMS has consulted with NMFS on five-year GOM oil and gas activities in the past. The most recent 5-year (2003-2007) consultation was formally requested by MMS in April 2002. A draft biological opinion was sent from NMFS to MMS in September 2002, and the final biological opinion was issued to MMS in November 2002.

The MMS has petitioned NMFS for programmatic rulemaking under the Marine Mammal Protection Act (MMPA) for Explosive Removal of Structures (EROS). This rulemaking also includes a programmatic section 7 consultation with NMFS under the ESA on these activities. The NMFS Proposed Rule for Explosive Removal of Structures operations was published in the Federal Register on April 7, 2006, and the ESA biological opinion was issued on August 28, 2006. Thus, EROS activities are not included in this consultation as part of the proposed action, but as part of the environmental baseline.

Consultation History

MMS submitted a biological assessment (BA) and request for section 7 consultation under the ESA on the OCS Leasing Program for 2007-2012 on June 5, 2006. In a letter dated July 28, 2006, NMFS requested additional information regarding the effects of pipelines and accidental oil spills on Gulf sturgeon critical habitat, the time of year of construction activities, pile driving, and other noise associated with the proposed action.

On December 21, 2006, MMS resubmitted a BA. Subsequent discussions through e-mail exchanges and teleconferences were held to gather additional information and discuss potential impacts resulting from vessel strikes, oil spills, and construction activities on the OCS. NMFS initiated consultation with MMS on May 1, 2007.

2 DESCRIPTION OF THE PROPOSED ACTION

MMS is the administrative agency responsible for the mineral leasing of submerged OCS lands and for the supervision of offshore operations after lease issuance. The Western and Central GOM are currently major oil- and gas-producing areas. The proposed action is for the exploration, development and production, and associated activities as a result of MMS lease sales of available OCS blocks in the WPA and CPA. Eleven area wide oil and gas lease sales in the WPA and CPA of the GOM OCS are scheduled during the five-year period. Under the proposed five-year program, two sales would be held each year, one in the WPA and one in the CPA (Table 1). The purpose of the lease sale portion of the proposed action is to offer for lease those areas currently available for lease that may contain economically recoverable oil and natural gas resources. The proposed lease sales will provide qualified bidders the opportunity to bid upon and lease acreage in the GOM OCS for the exploration, development, and production of oil and natural gas.

Table 1. Proposed WPA and CPA GOM OCS Lease Sales for 2007-2012.

Lease Sale Number	GOM Planning Area	Year of Lease Sale
204	WPA	2007
205	CPA	2007
206	CPA	2008
207	WPA	2008
208	CPA	2009
210	WPA	2009
213	CPA	2010
215	WPA	2010
216	CPA	2011
218	WPA	2011
222	CPA	2012

2.1 Action Area

The action area of the project includes all areas to be affected directly or indirectly by the action, and not merely the immediate area involved in the action (50 CFR 402.02). The action area is considered to include the Federal OCS waters in the WPA and CPA and all activities associated with the exploration, development, and production of those areas. The Federal OCS waters in the GOM begin 10 mi offshore of Florida; 3 mi offshore of Louisiana, Mississippi, and Alabama; and 10 mi offshore of Texas; and extend to the limits of the Exclusive Economic Zone (EEZ). The action area includes these waters as well as the coastal areas, ports, airspace, and waterways used by transport vessels related to the proposed action.

The northern boundary of the CPA is defined by the Federal-State boundary offshore Louisiana, Mississippi, and Alabama (Figure 1). The eastern boundary of the CPA is defined by the offshore boundary between Alabama and Florida, proceeding southeasterly to 26.19°N. latitude, thence southwesterly to 25.6°N. latitude. The western boundary of the CPA is defined by the offshore boundary between Texas and Louisiana, proceeding southeasterly to 28.43°N. latitude, thence south southwesterly to 27.49°N. latitude, thence south southeasterly to 25.80°N. latitude. The southern boundary of the CPA is defined by the continental shelf boundary with Mexico as established by the "Treaty Between the Government of the United States of America and the Government of the United Mexican States on the Delimitation of the Continental Shelf in the Western GOM Beyond 200 Nautical Miles," which took effect in January 2001, and by the limit of the U.S. EEZ in the area east of the continental shelf boundary with Mexico. The CPA consists of approximately 66.3 million acres (ac), of which approximately 34.8 million ac are not currently leased. The CPA is located from 4.8 to 354 kilometers (km) offshore in water depths ranging from 4 to 3,400 meters (m). A typical lease sale in the CPA is projected to yield 0.776-1.292 billion barrels of oil (BBO) and 3.236-5.229 trillion cubic feet (tcf) of gas. The entire CPA will be considered for possible leasing except:

- blocks that were formerly included within the Eastern Planning Area (EPA) and are within 100 mi of the Florida coast;
- blocks that were formerly included within the EPA and are under an existing Presidential withdrawal through the year 2012 as well as subject to annual congressional moratoria;
- blocks that are beyond the U.S. EEZ in the area known as the northern portion of the Eastern Gap; and
- whole and partial blocks that lie within the 1.4-nmi buffer zone north of the continental shelf boundary between the United States and Mexico.

The Central GOM Sale 205 area is the portion of the above-described CPA that was contained in the original Eastern GOM Sale 181 area, excluding blocks within 100 mi from the Florida coast. The Central GOM Sale 205 area consists of approximately 3.5 million ac, of which approximately 2.7 million ac are not currently leased. This is the only sale currently scheduled in the Five-Year Program that is not area-wide. Central GOM Sale 205 is projected to yield 0.115-0.149 BBO and 0.430-0.557 tcf of gas.

The western and northern boundaries of the WPA are defined by the Federal-State boundary offshore of Texas (Figure 1). The eastern boundary begins at the offshore boundary between Texas and Louisiana and proceeds southeasterly to 28.43°N latitude, thence south-southwesterly to 27.49°N latitude, thence south southeasterly to 25.80°N latitude. The southern boundary of the WPA is defined by the maritime boundary with Mexico that was established by the " Treaty Between the Government of the United States of America and the Government of the United Mexican States on the Delimitation of the Continental Shelf in the Western GOM Beyond 200 Nautical Miles," which took effect in January 2001. The WPA available consists of approximately 28.7 million ac, of which approximately 17.8 million ac are currently unleased. The WPA is located from

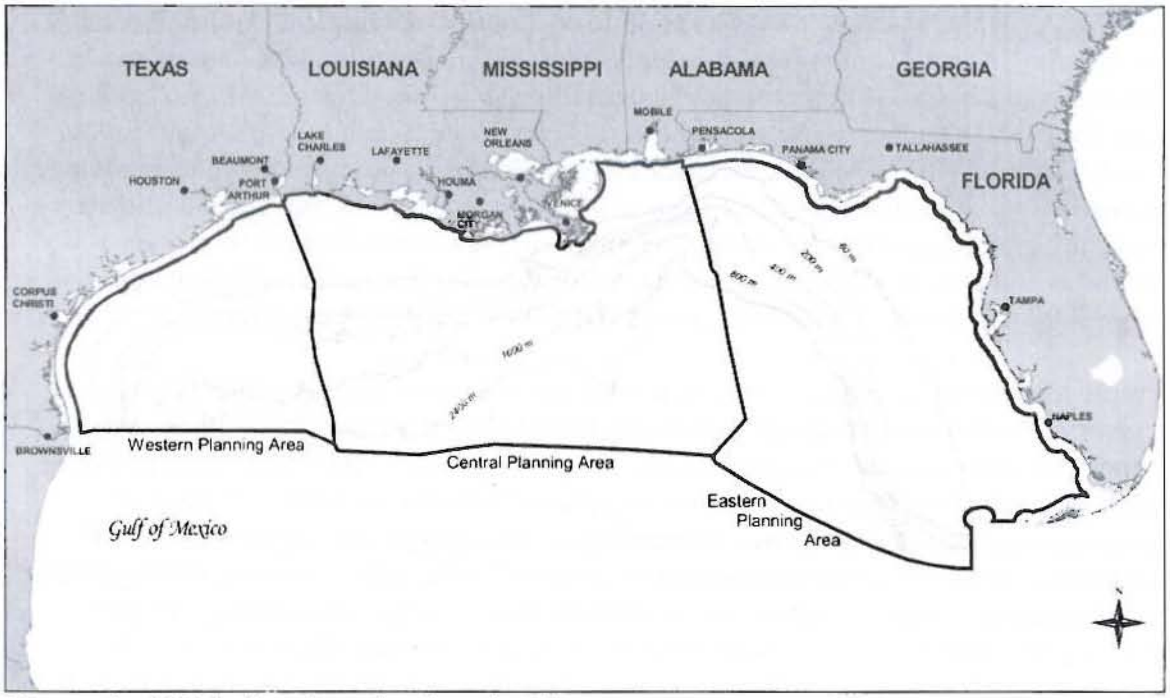

Figure 1. GOM oil and gas leasing planning areas.

14 to 357 km offshore in water depths ranging from 8-3,000 m. A typical lease sale in the WPA is projected to yield 0.242-0.423 BBO and 1.644-2.647 tcf of gas. The entire WPA will be considered for possible leasing except:

- whole and partial blocks within the boundary of the Flower Garden Banks National Marine Sanctuary; and
- whole and partial blocks that lie within the 1.4-nmi buffer zone north of the continental shelf boundary between the United States and Mexico.

2.2 Project Activities and Operations

The annual activity projections (Table 2) are estimates based on projected exploration and development activities, and impact-producing factors. These scenarios are only approximate because of future factors such as the contemporary economic marketplace, but represent the best assumptions and estimates of a set of future conditions that are considered reasonably foreseeable. Although the proposed action includes only proposed lease sales for the 2007-2012 five-year program, MMS bases estimates for all activities that are projected to occur from past, proposed, and future lease sales during the annual analysis period.

2.2.1 Seismic Surveying

Geophysical seismic surveys are performed to obtain information on surface and near-surface geology and on subsurface geologic formations. The MMS recently completed a programmatic EA (PEA) (U.S. Dept. of the Interior, Minerals Management Service 2004) on geological and geophysical (G&G) activities on the GOM OCS, and is seeking regulations governing the harassment and nonserious injury of several species of marine mammals, including sperm whales, under the Marine Mammal Protection Act (MMPA).

An MMPA petition package for G&G seismic operations, including an environmental assessment (EA), was sent to NMFS in December 2002. A petition was revised and NMFS issued a Notice of Intent in the Federal Register in November 2004. Rulemaking under the MMPA and a programmatic section 7 consultation under the ESA will follow completion of an EIS. The PEA includes a description of seismic surveying technologies and operations and is incorporated by reference. Currently, MMS implements seismic survey mitigation measures for marine mammals and sea turtles through term and conditions and conservation recommendations of previous lease sale biological opinions in the GOM (MMS NTL 2007-G02, APPENDIX A).

Typical seismic surveying operations tow an array of airguns and a streamer (signal receiver cable) behind the vessel 5-10 m (16-33 ft) below the sea surface. Piston-type airguns are used to release compressed air to create impulses. The airgun array produces a burst of underwater sound by releasing compressed air into the water column that creates an acoustical energy pulse. Depending on survey type and depth to the target formations, the release of compressed air every couple of seconds creates a regular series of strong acoustic impulses separated by silent periods lasting 7-16 seconds. Airgun arrays are designed to focus the sound energy downward through the water column. Acoustic (sound) signals are reflected off the subsurface sedimentary layers and recorded near the water surface by hydrophones spaced within streamer cables. These streamer cables are often 3 mi (5 km) or greater in length. Vessel speed is typically 4.5-6 knots (about 4-8 mph) with gear deployed. The 3D surveys carried out by seismic vendors can consist of several hundred OCS blocks. Multiple-source and multiple-streamer technologies are used for 3D seismic surveys. A typical 3D survey might employ a dual array of 18 guns per array. Each array might emit a 3,000-in^3 burst of compressed air at 2,000 pounds per square inch, generating approximately 4,500 kilojoule of acoustic energy for each burst. At 10 m (33 ft) from the source, the pressure experienced is approximately ambient pressure plus 1 atmosphere. The streamer array might consist of 6-8 parallel cables, each 6,000-8,000 m (19,685-26,247 ft) long, spaced 75 m (246 ft) apart.

High-resolution seismic surveys collect data on surficial geology used to identify potential shallow geologic hazards for engineering and site planning for bottom-founded structures. They are also used to identify environmental resources such as chemosynthetic community habitat. Deep-penetration, seismic surveys obtain data about geologic formations greater than 10,000 m (32,800 ft) below the seafloor. High-energy, marine seismic surveys include both 2D and 3D surveys. Data from 2D/3D surveys are used to map structural features to identify potential hydrocarbon traps.

Approximately 400-800 blocks would be surveyed by deep seismic operations in the WPA, and approximately 1,000-2,000 blocks in the CPA from the proposed lease sales. For postlease seismic surveys, it is projected proposed lease sale in the WPA would result in about 20 VSP operations and about 2,000 mi surveyed by high-resolution seismic during the life of the proposed action. Proposed lease sales in the CPA would result in about 30 VSP operations and 3,000-4,000 mi surveyed by high-resolution seismic during the 40-year life of the leases.

MMS estimates that seismic surveys are projected to follow the same trend as exploration activities, which are projected to peak in 2008-2010, steadily decline until 2027, and remain relatively steady throughout the second half of the 40-year lease periods. During the first 2-4 years, it is projected annually there would be 95-130 VSP operations, 12,500-16,500 miles surveyed by high-resolution seismic, and 1,500-3,000 blocks surveyed by deep seismic. During the second half of the lease periods, it is projected annually there would be 60-70 VSP operations, 6,200-8,300 mi surveyed by high-resolution seismic, and 1,200-2,500 blocks surveyed by deep seismic.

2.2.2 Construction

In addition to various pieces of support equipment used in construction, such as vessels and cranes, pile driving is the primary method by which fixed structures are attached to the seafloor and provide stability for other support structures. Classified as either impact hammers or vibratory hammers, the design of the hammer assembly varies depending upon the medium powering the system; however, most assemblies contain a specialized control unit, piston, ram, and anvil. The impact hammer systems used for OCS-related work

Table 2. Five-year annual projections in the Western and Central Planning Areas.

	Central Planning Area	Western Planning Area
Oil (Bbbl)	0.8-0.9	0.1-0.2
Gas (tcf)	3.4-3.5	1.5-1.7
Platforms Installed	108-114	41-48
Exploration and Delineation Wells	188-263	107-156
Production Development Wells	714-756	199-225
Non-Producing Development Wells	107-113	30-34
Vessels (round trips)	187,000–195,000	38,000-43,000
Helicopter (Take Offs/Landings)	1,000,000	500,000
Pipelines (km)	1,200	500

predominantly utilize steam, pneumatic, or hydraulic assemblies. Most of the steam and pneumatic systems used in the GOM are limited to surface operations and have energy outputs (torque) ranging from 15,000-60,000 ft/lbs (20-82 kilonewton meters (kNm)). Hydraulic impact hammer systems can be used in both surface and sub-sea operations and most generally range from 11,000-370,000 ft/lbs (15-500 kNm). Almost all vibratory hammer systems use hydraulic power and due to their configuration, they can be used for both surface and sub-sea operations.

Operators determine the type and size of pile driving equipment they require based upon the dimensions and design of the object being driven, water depths, equipment configuration (surface vs. sub-sea), sediment/substrate types, and the nature of the operations being conducted. Sediment types are varied in the GOM, but for shallow seabed activities such as these they are generally classified as consisting of muds (directly off river deltas/outlets), clays (mostly from the Louisiana-Texas border westward), and unconsolidated sands or silt (most of the shelf of the Northern GOM).

Each sediment type offers differing levels of friction that must be overcome to allow the pile to penetrate to a sufficient depth. There are two primary pile-driving operations on the GOM OCS: 1) the setting of casing conductors (also know as *drive pipe*) for drilling operations; and 2) pile emplacement for the seabed securing of oil and gas structures and facilities.

Casing Conductor (Drive Pipe) Installation

Due to the frequency of exploratory and development drilling operations on the GOM OCS, the greatest number of pile-driving operations involve the setting or installation of casing conductors. Most casing conductors range in diameter from 12-36 in and have wall thicknesses that run from ¼-¾ in and are generally driven into the substrate until the conductor "meets refusal" or cannot be driven further without damage. Conductor casings can also be jetted into the seabed; however, the ease of mobilization of hammer drivers coupled with their speed of penetration, minimizes the use of jetting equipment, which requires more time to deploy and is often unviable due to water depth and sediment type. Most casing conductors driving operations occur in water depths <200 m (Figure 2)

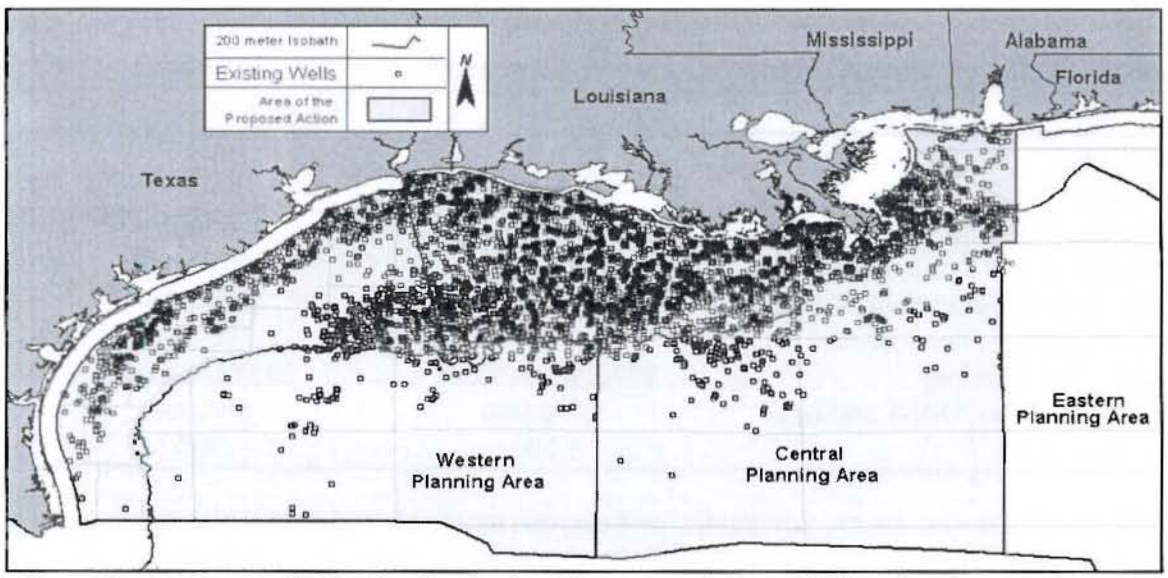

Figure 2. Current well distribution in the Western and Central Planning Areas.

Structure/Facility Pile Installation

Pile-driving operations are also conducted during oil and gas structure/facility installations on the GOM OCS. Structure piles are generally forged or rolled-sheet constructed steel pipes that range in diameter from 24-84 in and have wall thicknesses that run from ½-2 in. The piles are inserted into the legs of the platform jackets, along the inner wall of a caisson, or into sleeves configured into skirt bracings or seafloor templates for structures in certain deepwater/unstable environments. As with conductor casings, piles are generally driven into the substrate until it "meets refusal" or reaches a sufficient depth to ensure stability. Once set to the proper depth/refusal, the pile is then welded or grouted to the jacket leg, caisson, or sleeve to affix the facility to the seabed. Over the last 10 years, an average of 137 structures were installed annually in the Central and Western GOM with the majority concentrated on the shelf in water depths less than 200 m (Figure 3).

2.2.3 Development and Production Drilling

A production well is drilled to exploit a discovered or known hydrocarbon field. Production wells can collectively be termed development wells. Production wells may be drilled from movable structures, such as jack-up rigs with fixed bottom-supported structures, vertically floating moored structures, floating production facilities (often called semi-submersibles), and drillships (dynamically positioned drilling vessels). The type of production structure installed at a site depends mainly on water depth. The number of wells per structure varies according to the type of production structure used, the prospect size, and the drilling/production strategy deployed for the drilling program and for resource conservation. Systems used to produce hydrocarbons can be fixed, floating, or sub-sea in deeper waters.

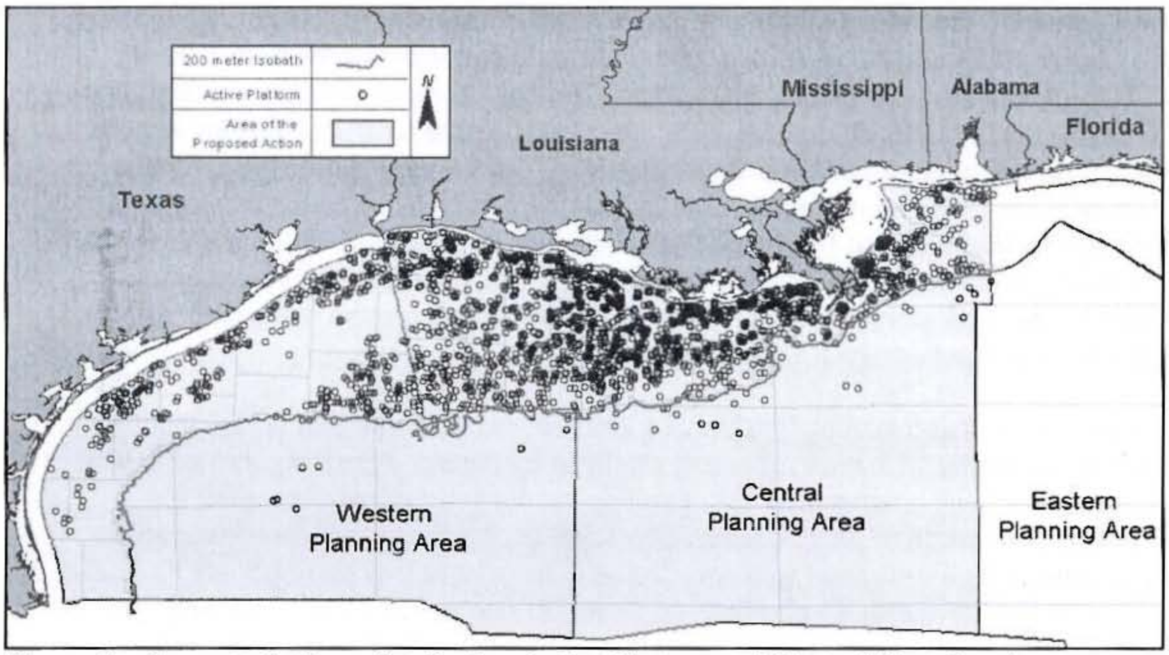

Figure 3. Current platform distribution in the Western and Central Planning Areas.

2.2.4 Production Platforms

Offshore platforms are common structures used in the development of offshore oil and gas resources. The purpose of a platform is to house production and drilling equipment and living quarters for personnel (on manned platforms). A platform consists of two major components: an underwater jacket or tower and an above water deck. Platforms are fabricated onshore and then towed to an offshore location for installation. Facilities where platforms are fabricated are called platform fabrication yards. Production operations at fabrication yards include the cutting and welding of steel components and the construction of living quarters and other structures, as well as the assembly of platform components. Fixed platform fabrication can be subdivided into two major tasks: jacket fabrication and deck fabrication. Platform structures are transported offshore and installation may take place over a period of a week to a month at the beginning of a platform's 20- to 40-year production life. Derrick barges may be used to upright and position structures. Moorings and anchors are usually attached to keep the structure on station. Many platforms require that piles be driven to which the platform is attached by welding the components together. Commissioning activities involve all of the interconnecting and testing of the structure's modular components.

Several types of production systems are used for offshore oil and gas development in the WPA and CPA, and types vary by water depth in which the structures may be found. A fixed platform is the most commonly used type of production system in the northern GOM. A fixed platform is a large skeletal structure extending from the bottom of the ocean to above the water level. It consists of a metal jacket that is attached to the ocean bottom with the piles, and a deck that accommodates drilling and production equipment and living quarters. Fixed platforms are typically installed in water depths up to 1,500 ft. A compliant tower is similar to a fixed platform; however, the underwater section is not a jacket but a narrow, flexible tower that, because of the flexibility of its structure, can move around in the horizontal dimension, thereby withstanding significant wave and wind impact. Compliant towers are typically installed in water depth from 1,000 to 2,000 ft. Tension and mini-tension leg platforms do not have skeletal structures extending all the way to the ocean floor. Instead, they consist of floating structures that are kept in place by steel tendons attached to the ocean floor. Tension leg platforms can be used in different water depth ranges, up to 4,000 ft. A spar platform (a floating caisson) consists of a large vertical hull that is moored to the ocean floor with up to 20 lines. Above the hull sits the deck with production equipment and living quarters. At present, spar platforms are used in water depths up to 3,000 ft; however, present technology allows installation in waters as deep as 7,500 ft.

A floating production system consists of a semi-submersible unit that is kept stationary either by anchoring with wire ropes and chains or by the use of rotating thrusters, which self propel the semi-submersible unit. Floating production systems are suited for deepwater production in water depths up to 7,500 ft. A sub-sea system consists of a single sub-sea well or several wells producing either to a nearby platform or to a distant production facility through a pipeline and manifold system. At present, sub-sea systems are used in water depths exceeding 5,000 ft. A floating production, storage, and offloading (FPSO) system consists of a large vessel that houses production equipment. It collects oil from several sub-sea wells, stores the oil, and periodically offloads it to a shuttle tanker. FPSO systems are particularly useful in development of remote oil fields where pipeline infrastructure is not available.

2.2.5 Pipelines

Pipelines are the primary method used to transport a variety of liquid and gaseous products between OCS production sites and onshore facilities servicing the GOM. These products include unprocessed (bulk) oil and gas; mixtures of gas and condensate; mixtures of gas and oil; processed condensate, oil, or gas; produced water; methanol; and a variety of chemicals used by the OCS industry offshore. It is expected that pipelines from most of the new offshore production facilities will connect to the existing pipeline infrastructure. Almost 100 percent of produced oil from a lease in the WPA or the CPA, out to 800 m, is expected to be transported via pipelines. MMS estimates pipelines will continue to be the primary means of transporting oil in the future, with approximately 92 to 99 percent of the oil in the WPA, and 95 to 99 percent of the oil in the CPA transported through pipelines.

Pipelines in the GOM are designated as either gathering lines or trunklines. Gathering lines are typically shorter segments of small-diameter pipelines that transport the well stream from one or more wells to a production facility or from a production facility to a central facility serving one or several leases (e.g., a trunkline or central storage or processing terminal). Trunklines are typically large-diameter pipelines that receive and mix similar production products and transport them from the production fields to shore. A trunkline may contain production from many discovery wells drilled on several hydrocarbon fields. The OCS-related pipelines near shore and onshore may merge with pipelines carrying materials produced in State territories for transport to processing facilities or to connections with pipelines located farther inland.

2.2.6 Vessel Traffic

Barges may be used offshore to transport oil and gas, supplies such as chemicals or drilling mud, or wastes between shore bases and offshore platforms. Barges are non-self-propelled vessels that must be accompanied by one or more tugs. Because of this, barge transport is usually constrained to shallow waters of the GOM, close to the shoreline. Barging is used very infrequently as an interim transport system prior to the installation of a pipeline system. About 1 percent of the oil produced during the proposed actions in less than 60 m in both the WPA and the CPA is expected to be barged to shore over the 40-year life of the leases.

Shuttle tanker transport of OCS-produced oil is expected to be part of industry activities with 1 to 43 percent of oil transport in the CPA and 1 to 59 percent in the WPA. The expectation over the 2007-2046 lifetime of the proposed lease sales, is 1 to 5 percent and 1 to 8 percent, respectively. Floating production, storage, and offloading (FPSO) systems and associated tanker transport of OCS-produced oil may use shuttle tankers or self-propelled barges for transport to shore.

Service vessels are one of the primary modes of transporting personnel between service bases and offshore platforms, drilling rigs, derrick barges, and pipeline construction barges. In addition to offshore personnel, service vessels carry cargo (i.e., freshwater, fuel, cement, barite, liquid drilling fluids, tubulars, equipment, and food) offshore. In general, the new type of vessels built will continue to be larger, deeper drafted, and more technologically advanced for deepwater activities.

Service vessels that support various requirements of offshore oil and gas activities are categorized into supply, crew, and utility vessels. Large supply boats (50 to 70 m in length) with a capacity of 300 tons and draft of 3.5 m when loaded make up a large proportion of service vessels in the GOM. Crew and utility boats are about 30 m in length. Service vessels utilized in deep water include offshore supply vessels, fast supply vessels, and anchor-handling towing supply/mooring vessels; vessels employed in deepwater operations typically are larger and/or faster than those usually supporting oil and gas operations in shallower water closer to shore. Compared to shelf-bound service vessels, deepwater service vessels have improved hull designs (increased efficiency and speed). Service vessels primarily used in deep water are offshore supply vessels, fast supply vessels, and anchor-handling/towing/supply/mooring vessels. Other deepwater specialty service vessels include well stimulation vessels. The offshore supply vessel and anchor-handling and anchor-handling/towing/supply/mooring vessels carry the same type of cargo (i.e., freshwater, fuel, cement, barite, liquid drilling fluids, tubulars, equipment, food, and miscellaneous supplies) but have different functions. As the number of deep-water development facilities located greater distances from shore increases, larger supply vessels with greater cargo carrying capacities and fast crew boats are being used.

A trip is considered the transportation from a service base to an offshore site and back (a round trip). There are approximately eight round trips per week in support of drilling an exploration well and six round trips per week in support of drilling a development well. A platform is estimated to require one to two vessel trips per week over its 25-year production life. All trips are assumed to originate from the service base. Using some assumptions about the number of vessel crew members per boat, number of trips to existing as well as projected platforms, the number of development wells, the number of trips per well per week, transit times, and distances to sites from service bases, etc., the total number of service vessel trips has been estimated by MMS to be between 225,000-238,000 round trips annually, with most trips occurring in the CPA.

The five-year projections for annual vessel round trips are estimated to be 187,000-195,000 in the CPA, with 4,627,000-5,887,000 service-vessel trips estimated to occur in the CPA over the 40-year OCS Program. In the WPA, five-year projections for annual vessel round trips is estimated to be 38,000-43,000, with 2,087,000-2,722,000 round trips estimated to occur over 40 years.

2.2.7 Helicopters

Helicopters are another mode of transporting personnel between service bases and offshore platforms, drilling rigs, derrick barges, and pipeline construction barges. Helicopters are routinely used for crew changes and at other times to transport management and special service personnel to offshore exploration and production sites. In addition, equipment and supplies are sometimes transported. Deepwater operations require helicopters that travel farther and faster, carry more personnel, are all-weather capable, and have lower operating costs.

In the past, helicopter activity scenarios were based on round trips. However, industry needs and uses of helicopters has been changing and the flight logistics often involve numerous stops, and completing a true round trip (back to the original location) may take days or longer. Helicopter activity scenarios are now given in flight segments; that is, a take-off to a landing, regardless of length. In areas of heavy industry activity, helicopter segments can be a matter of minutes, hopping from one structure to the next. The projected annual number of helicopter segments in the CPA and WPA combined is 1,500,000. Approximately 1,000,000 of these would occur in the CPA and 500,000 in the WPA. When calculated by depth, the shallowest depths (0-60 m) will have over 80 percent of the helicopter activity over the 40-year OCS Program in the CPA. In the WPA, for the same 40-year OCS Program timeframe, shallow areas are projected to have over 75 percent of the helicopter activity.

2.3 Proposed Harm Avoidance Measures for Protected Species

MMS proposes the *Protected Species Stipulation* that is designed to minimize or avoid potential adverse impacts to federally protected species (e.g., sea turtles, marine mammals, and other listed species). The stipulations (or harm avoidance measures) considered in this biological opinion appear in the Appendices, and include the following:

1. The MMS requires that all seismic surveys employ mandatory mitigation measures including the use of a 500-m "exclusion zone", ramp-up and shut-down procedures, visual monitoring, and reporting. Seismic operations must immediately cease when whales are detected within the 500-m exclusion zone. Ramp-up procedures and seismic surveys may be initiated only during daylight unless alternate monitoring methods approved by MMS are used.

2. The MMS will condition all permits issued to lessees and their operators to require them to collect and remove flotsam resulting from activities related to exploration, development, and production of this lease.

3. The MMS will require that vessel operators and crews watch for marine mammals and sea turtles, reduce vessel speed to 10 knots or less when assemblages of cetaceans are observed, and maintain a distance of 90 m or greater from whales and a distance of 45 m or greater from small cetaceans and sea turtles.

4. The MMS will condition all permits issued to lessees and their operators to require them to post signs in prominent places on all vessels and platforms used as a result of activities related to exploration, development, and production of this lease detailing the reasons (legal and ecological) why the release of debris must be eliminated.

5. The MMS will require lessees and operators to instruct offshore personnel to immediately report all sightings and locations of injured or dead protected species (marine mammals and sea turtles) to the appropriate stranding network. If oil and gas industry activity is responsible for the injured or dead animals (e.g., because of a vessel strike), the responsible parties should remain available to assist the stranding network. If the injury or death is caused by a vessel collision, the responsible party must notify MMS within 24 hours of the strike.

6. The MMS will require oil-spill contingency planning to identify important habitats, including designated critical habitat, used by listed species (e.g., sea

turtle nesting beaches and piping plover critical habitat) and will require the strategic placement of spill cleanup equipment to be used only by personnel trained in less intrusive cleanup techniques on beach and bay shores.

Notice to Lessees and Operators

The MMS also issues Notices to Lessees and Operators (NTLs) in order to clarify, describe, or interpret regulation or OCS standards. The pertinent NTLs considered in this biological opinion, and that describe in greater detail some of the above-mentioned lease stipulations, include:

1. "Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program" (NTL 2007-G02, APPENDIX A).

2. "Vessel Strike Avoidance and Injured/Dead Protected Species Reporting" (NTL 2007-G04, APPENDIX B);

3. "Marine Trash and Debris Awareness and Elimination" (NTL 2007-G03, APPENDIX C); and

3 LISTED SPECIES AND CRITICAL HABITAT

Table 3. Listed species and critical habitat in the action area.

Common Name	Scientific Name	Status
Marine Mammals		
sperm whale	*Physeter macrocephalus*	endangered
Sea Turtles		
leatherback sea turtle	*Dermochelys coriacea*	endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	endangered
hawksbill sea turtle	*Eretmochelys imbricata*	endangered
green sea turtle[a]	*Chelonia mydas*	threatened
loggerhead sea turtle	*Caretta caretta*	threatened
Fish		
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	threatened
Critical Habitat		
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Unit 8

[a]Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific coast of Mexico, which are listed as endangered.

The endangered and threatened species, and designated critical habitat under the jurisdiction of NMFS that appear in Table 3 occur in the action area. NMFS has designated critical habitat for the Gulf sturgeon in the action area.

3.1 Effects to Listed Species Considered and Discounted

NMFS has analyzed several aspects of the proposed action during consultation with MMS for potential impacts to listed species and their habitats, and activities determined not to affect any listed species or designated critical habitat in the action area have been excluded from further analysis. Activities that may affect listed species or designated critical habitat were considered further for their potential to adversely affect listed species, and those determined to be insignificant and/or discountable are discussed in the following subsections. In addition to the direct effects of the action on listed species, this section also assesses the indirect effects of the proposed action, and the potential for any interrelated or interdependent effects of other activities (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). For activities that could potentially result in take, the proposed harm avoidance measures were also assessed for their effectiveness at reducing the likelihood of impacts to discountable levels, or by reducing the magnitude of potential impacts to insignificant levels.

3.1.1 Vessel Strikes and Sperm Whales

Increased traffic from support vessels involved in survey, service, or shuttle functions could increase the probability of collisions between vessels and sperm whales. It is estimated that a maximum of 238,000 vessel round trips will occur annually, of which 55 percent are expected to occur in sperm whale habitat for vessels transiting in water depths greater than 200 m. Adverse reactions by whales to vessel activity have been recorded, and all are vulnerable to collisions with vessels, with incidents of strikes with juveniles and calves occurring more frequently than with adult animals. Some individuals may be able to detect and avoid underway vessels; however, the behavior of some individuals and age classes, and the behavioral characteristics of the species, behavioral state, or physical condition may result in an increased vulnerability to disturbance and injury from vessels operating at speeds over 10 knots (e.g., surface-active animals, sick animals, resting animals, and calfs).

Vessels have the potential to affect sperm whales in deeper, pelagic waters (>200 m) where sperm whales are typically found in the GOM. A vessel's operational speed influences the probability of animal detection and reaction time. Tugs are not believed to pose any significant threat of collision with sperm whales in the GOM because of their relatively slow transit speeds and operation in coastal waters where sperm whales are not found. Vessels are known to strike and injure larger sea life (e.g., sperm whales), mostly due to bow strikes (Laist et al. 2001) from vessels operating at faster speeds. Reported ship collision accounts suggest that serious injury to whales rarely occurs at speeds below 10 knots (Laist et al. 2001). A vessel's operational speed also influences the probability of animal detection and reaction time. At slower vessel speeds, a particular location ahead of the vessel is within visual range for a longer period of time before the vessel arrives at that location. For example, a vessel traveling at 16 knots that sees a whale 1,000 m ahead will arrive at the whale's position in 2.02 minutes; at 10 knots, the vessel will arrive at the whale's position in 3.23 minutes.

NMFS considers vessel approaches within 90 m to have the potential for harassment of marine mammals, and close approaches within tens of meters to have the potential to injure a marine mammal. A few individuals occurring within close proximity may be expected to be at risk of injury over the lifetime of the action. For example, the USS BURKELEY reported striking a whale of uncertain species at night on June 25, 2001, while undergoing high speed sea trials out of Pascagoula, Mississippi. Based on the location and size of the struck animal, it is believed to have been a sperm whale. Although vessel strikes do occur, these events appear to be infrequent with this species in offshore waters of the GOM, and are not expected to injure sperm whales from routine OCS vessel traffic associated with the proposed lease sales. However, there is a potential for sperm whales to be potentially harassed by passing vessels, and magnitude of this risk is considered in the following analysis.

Although the ESA defines prohibited takes of listed animals to include harassment, the ESA does not define harassment, nor has NMFS defined this term through regulation. However, the MMPA of 1972, as amended, defines harassment as any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild, or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption to behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (16 USC 1362(18)(A)).

NMFS is particularly concerned about harassment to individuals or populations that may manifest as an animal that fails to feed successfully, breed successfully (which can result from feeding failure), or complete its life history because of altered environmental variables or behavioral patterns. This analysis includes an examination of the responses at the level of individual animals that could result in harassment, and any population level consequences, such as a reduction in numbers, distribution, or reproduction.

Behavioral reactions by whales to vessel activity have been recorded. Aerial surveys have confirmed that sperm whales are present in the GOM throughout the year. Sperm whales are the most often sighted and abundant cetaceans in offshore waters greater than 200 m in depth. Based on active leases as of April 2006, 55 percent of those leases occur in water depths greater than 200 m (3,606 occur on water depths from 0-200 m; 4,501 occur in water depth greater than 200 m); however, fewer leases occur in greater depths where sperm whales are found in higher densities. The mean density of sperm whales in the GOM is 0.35 per 100 km^2 and is used for this analysis. Due to the uncertainties regarding future vessel activity in deeper offshore waters that may affect sperm whales, a conservative estimate of potential harassment was calculated based on the following assumptions:

- sperm whale density of .0035 km^{-2};
- average offshore supply vessel measuring 70 x 16 m (0.070 x 0.016 km);
- a harassment zone of 0.090 km;

- a vessel may affect a sperm whale only once per round trip;
- 55 percent of the maximum number of annual vessel trips will occur in water depth ≥200 m (130,900);
- a random distribution of vessels and whales; and
- whales and vessels are stationary at the surface.

By adding a potential harassment zone to a vessel's dimensions, the harassment dimensions of a vessel is a rectangular-shaped space measuring 0.160 x 0.106 km. A potential harassment area of 0.017 km^2 can be calculated for a single vessel, and a maximum harassment area of 2,225 km^2 resulting from 130,900 vessel trips annually. Based on the mean sperm whale density in the GOM, an estimated 7.8 whales could potentially be found within the area of harassment annually. This estimate assumes a vessel is stationary; however, since vessels are underway between destinations, the probability for a randomly positioned, stationary whale to occur within the harassment zone of a vessel may be expected to increase as a vessel moves through the water, but the assumption that every vessel trip has the potential to affect a sperm whale is considered a conservative estimate of actual encounter rates.

Although the above calculation provides an estimation of potential encounters and potential risks vessels may pose to sperm whales, whales are not randomly distributed and may be expected to occur in greater densities in some regions than others depending on oceanographic features and other factors affecting their distribution. Such changes in distribution may significantly affect where and when sperm whales may be encountered in the GOM. In reality, both sperm whales and vessels may have the opportunity to avoid one another. When encounters within 90 m do occur, sperm whales generally avoid underway vessels.

To reduce the risk of encounters with sperm whales, MMS will implement NMFS' vessel strike avoidance measures for protected species, as implemented in MMS NTL 2007-G04 (APPENDIX B). With implementation of these measures, by maintaining a lookout for marine mammals and taking prudent actions to avoid collisions with them, NMFS believes that the likelihood of collisions between vessels and sperm whales will be reduced to insignificant levels. The observed avoidance of passing vessels by sperm whales is considered an advantageous response to avoid a potential threat, such as may occur in response to a predator such as killer whales, and is not expected to result in any significant response on migration, breathing, nursing, breeding, feeding, or sheltering to individuals, or have any consequences at the level of the population. With implementation of the vessel strike avoidance measures requirement to maintain a distance of 90 m from sperm whales, the potential for harassment of 7 or 8 whales annually is expected to be reduced to discountable levels. The potential for vessels striking sea turtles is discussed in the Effects of the Action in section 7 of this biological opinion.

3.1.2 Effects of Seismic Surveys on Sea Turtles

Studies regarding sea turtle hearing indicate that adult green, loggerhead, and Kemp's ridley turtles are sensitive to low to mid-frequency sounds. Other species of sea turtles with unknown hearing measurements have similar anatomies and are expected to have similar hearing ranges from those that have been measured. Although more hearing measurements are needed, the available data suggest that sea turtles are sensitive to frequencies from approximately 200 to 2,000 Hz. Some possible reactions to low frequency sounds include startle responses, rapid swimming, and swimming towards the surface at the onset of the sound.

In a study measuring the responses of captive green and loggerhead sea turtles exposed to seismic airgun pulses at 10-sec intervals, the sea turtles increased their swimming speeds when exposed to levels above 166 dB re 1 μPa rms (McCauley et al. 2000). The behavior of the sea turtles became more erratic when received levels exceeded 175 dB re 1 μPa. Loggerhead sea turtles' reactions to airguns held in an enclosure in a 10-m deep canal maintained a stand-off range of 30 m when exposed (O'Hara and Wilcox 1990). In another study, loggerhead sea turtles in a netted enclosure initially exhibited avoidance responses, but the avoidance response waned quickly (Moein et al. 1994). The change in behavior may have been due to habituation or reduced hearing sensitivity resulting from exposure to the noise. Other studies have also demonstrated that sea turtles behaviorally respond to exposure to noise, but the exposure levels and frequencies were not reported.

Based on this information, sea turtles exposed to airgun pulses during the proposed survey may exhibit avoidance behavior. Studies suggest that avoidance may begin at levels above 166 dB re 1 μPa. Avoidance behavior may shorten the exposure period; however, the avoidance behavior could potentially disrupt normal behaviors. Although sea turtles may be expected to avoid the vicinity of seismic surveys, important habitat for sea turtles is overall associated with greater habitat quality (i.e., foraging habitat, juvenile habitat, and nesting beaches) along inshore and nearshore waters of the GOM. Any reactions of sea turtles to seismic surveys will be limited to an avoidance response in the vicinity of the surveys. Sea turtles behaviorally disrupted would be expected to resume their behavior after the seismic vessel has moved out of their immediate area, without significant impairment of feeding, migration, or other behaviors due to the short duration of exposure. Sea turtles also occur in greater abundances in closer to shore than in offshore waters, with the exception of foraging leatherbacks. With implementation of the MMS NTL No. 2007-G02 (APPENDIX A), the potentially for adverse effects to sea turtles will be reduced to discountable levels.

3.1.3 Vessel Noise and Operation

Vessels transmit noise through water and cumulatively are a significant contributor to increases in ambient noise levels in many areas. The dominant source of vessel noise from the proposed action is propeller cavitation, although other ancillary noises may be produced. The intensity of noise from service vessels is roughly related to ship size and speed. Large ships tend to be noisier than small ones, and ships underway with a full load (or towing or pushing a load) produce more noise than unladen vessels. Shipping traffic is most significant at frequencies from 20 to 300 Hz. Supertankers may generate peak sources levels of 185 to 190 dB re 1 μPa-m at about 7 Hz, and 160 dB re 1 μPa-m at frequencies of 20 to 60 Hz (Richardson et al. 1995). However, vessel traffic proposed in the action would produce lower levels of noise of 150 to 170 dB re 1 μPa-m at frequencies below 1,000 Hz. A tug pulling a barge generates 164 dB re 1 μPa-m when empty and 170 dB re 1 μPa-m loaded. A tug and barge underway at 18 km/h can generate broadband source levels of 171 dB re 1 μPa-m. A small crew boat produces 156 dB re 1 μPa-m at 90 Hz.

Increases in ambient noise are believed to be a potential threat for marine animals having greatest hearing sensitivities at lower frequencies that overlap with the main frequency level of energy produced by vessels, such as those of mysticetes, sea turtles, and fishes. Because vessel noise is continuous in the marine environment and can propagate great distances, masking and behavioral disturbance may be important effects on mysticetes, which can hear in the frequency range produced by vessels, but is not expected for odontocetes, such as sperm whales, which hear at higher frequencies.

When higher frequencies are produced by vessel operation, they are generally of lower sound levels and do not propagate great distances. Any potential for disturbance from noise would be within close proximity to a vessel. Sperm whale responses to vessels may vary depending on the type of vessel involved. Sperm whales have been observed to reduce surface times with fewer blows per surface, exhibit shorter intervals between blows, and exhibit reduced frequency of dives with raised flukes, while other whales tolerate boat presence (Gordon et al. 1992). Many reactions observed by sperm whales appear to be associated with the level of noise produced by the vessels (Richardson et al. 1995). The variable reactions by individual sperm whales may indicate some habituation on the part of those individuals that do not exhibit any reactions or may be indicative of individual variation in the behavioral patterns that are also associated with other marine mammals. Vessel noise and the presence of the vessel on the water may potentially affect the behavior of animals at relatively close distances where the vessel noise is more audible and the vessel may be visible from both below and above the surface. To reduce the risk of interactions with sperm whales, MMS will implement NMFS' vessel strike avoidance measures for protected species, as implemented in MMS NTL 2007-G04 (APPENDIX B). The NTL requires that vessel operators maintain a distance of 90 m from sperm whales that would reduce potential disturbances to this species to discountable levels.

Effects on sea turtles are not expected since these species do not appear to greatly utilize environmental sound, at least at far distances in the open ocean. For sea turtles, avoidance appears to be more of a function of the physical presence of the vessel rather than the noise produced. To reduce the potential risk of interactions with sea turtles, MMS will implement NMFS' vessel strike avoidance measures for protected species, as implemented in MMS NTL 2007-G04 (APPENDIX B). The NTL requires that vessel operators maintain a distance of 45 m from sea turtles that would reduce the potential effects from the physical presence of the vessels to discountable levels.

It is not likely that lease sales in the WPA will result in any trips east of the Mississippi River that would affect the designated critical habitat of the Gulf sturgeon. In the CPA major navigation channels are excluded from critical habitat. Gulf sturgeon are not expected to be impacted by noise and direct physical impacts associated with vessel traffic associated with oil and gas activities in the WPA and CPA, since vessels are not expected to operate in this species' habitat.

3.1.4 Helicopter Operation

Aircraft operation may ensonify broad areas, albeit for short periods at any one location while in transit. Helicopters produce sounds (resulting from rotors) generally below 500 Hz with estimated source levels for a Bell 212 helicopter of 149 to 151 dB re 1 μPa-m (Richardson et al. 1995). At incident angles greater than 13° from the vertical, much of the incident noise from passing aircraft is reflected and does not penetrate the water (Urick 1972). Therefore, NMFS believes underwater noise from helicopters is generally very brief in duration, compared with the duration of audibility in the air, and the effects of underwater noise from helicopters on listed species of sperm whales, sea turtles, and Gulf sturgeon will be insignificant.

Helicopter noise may affect sea turtles and sperm whales at the surface by eliciting startle responses due to increasing noise of a helicopter as it rapidly approaches, or due to the physical presence of the helicopter in the air. A hovering or circling aircraft would be expected to have a potentially greater affect on an animal. The modes by which an animal may be affected and the magnitude of those affects may not only depend on the helicopter operation (i.e., hovering or circling), but also on the species, hearing ability, or behavior of the animal. Routine OCS helicopter traffic would not be expected to disturb animals for extended periods, provided pilots do not alter their flight patterns to more closely observe or photograph marine mammals. Helicopters, while flying offshore, generally maintain altitudes above 700 ft during transit to and from a working area, and at an altitude of about 500 ft between platforms. The duration of the effects resulting from a startle response are expected to be short-term during routine flights, and the potential effects will be insignificant to sea turtles and sperm whales.

3.1.5 Marine Debris

Although the intentional discharge of marine debris is prohibited by law (30 CFR 250.40 and MARPOL, Annex V, P.L. 100-220 [101 St. 1458]), accidental losses of debris do occur. Marine debris may originate from a variety of sources, yet the sources are usually not identified. A published study regarding shoreline trash at Padre Island National Seashore reported that approximately 10 percent of marine trash that washed ashore originated from offshore structures and/or vessels associated with the oil and gas industry. The incidental ingestion of marine debris and entanglement continue to adversely affect listed species and has been considered in preparation of the waste management plan for this project. MMS has proposed incorporation of an annual training and certification requirement for marine debris education and elimination for all offshore personnel, including the potential for adverse effects to listed species as required by MMS NTL 2007-G03 (APPENDIX C). NMFS believes that, with implementation of these measures, the potential for adverse impacts to listed species resulting from accidental discharges of trash and debris is discountable.

3.1.6 Construction Noise

Gulf sturgeon are not expected to be found in any OCS area in which MMS-permitted pile driving activity could occur and will not be affected. Pile driving is not required for deepwater structure installations; however, few activities do occur in waters depths >200 m. Because sperm whales are most commonly found in greater water depths > 1,000 m and most installations occur in shallower depths, the risk of sperm whales being affected by pile driving noise is considered discountable. Although vessel noise is a relatively constant contributor to ambient noise levels in the GOM, NMFS considers pile driving to be a louder and frequent noise source resulting from many, but transient point sources of noise from construction activities. The noise from these activities over the continental shelf and slope regions of the OCS has the greatest potential to affect listed species of sea turtles because the turtles are routinely found in these areas.

Although pile-driving noise is not a continuous signal, repeated blows from the hammer (generally several seconds apart) could potentially affect the behavior of sea turtles in the area. Most structure installation requiring pile driving is expected to occur over the continental shelf in waters less than 400 m. Casing conductor driving operations occur in all water depths throughout the Central and Western GOM, but are concentrated on the shelf in waters less than 200 m in federal waters, and would therefore affect mostly listed species of sea turtles.

Despite a gradual decrease during the past 4 or 5 years due to increased deepwater activities, statistics compiled over the last 10 years indicate that an average of over 1,100 drilling operations are conducted annually in the Central and Western GOM. Since current MMS permitting and database processes do not track the method of conductor casing installation, it is assumed that the majority of the new drilling activities will use an impact hammer, as this is the preferred method of pile driving in the GOM. Pile-driving operations supporting oil and gas activities in the GOM involve the same basic principles as on-shore or coastal/near-shore activities; using specialized equipment to force an object into the sediment to affix an object that requires a stationary hold or foundation. Unlike on-shore activities, pile-driving operations on the GOM OCS involve the added complexity that comes with mobilizing, rigging, powering, and controlling complex equipment from platforms and vessels often dozens to thousands of feet above the substrate surface and in many instances, requiring operations in a sub-sea environment.

Pile driving noise is a relatively broadband signal that may be audible to many species. There is a potential for sea turtles to avoid the ensonified area of pile driving. The sound waves produced by pile driving projects may deter animals by acting as an acoustic deterrent from the construction area. Deterrence may be an important effect of pile driving if it disrupts feeding, mating, or sheltering of individuals. Sea turtles are found in greater abundances in nearshore and inshore waters (Epperly et al. 2002) than offshore habitats where the proposed lease sale activities would potentially occur. The higher abundance of animals in coastal habitats is attributed to the higher quality of these coastal habitats for these species than those offshore. Although adverse effects on fishes have been reported in riverine and coastal habitats, these effects are not be expected for sea turtles in the offshore environment where they occur in lesser abundances, are more transient, and wouldn't be expected to be attracted to an area where new construction is occurring. Additionally, new construction activities do not have an established marine community surrounding it that may attract marine life (e.g., oil and gas platforms already installed). Based on the above analysis, the likelihood of adverse affects on sea turtles from pile driving is considered to be discountable.

3.1.7 Operation Noise

Noise associated with decommissioning phases has been considered in a programmatic biological opinion completed in 2007. Geological and geophysical surveying is currently being considered in a programmatic consultation with MMS. All offshore activities on the OCS discussed in the section will not affect Gulf sturgeon because these activities are beyond the range of this species. Noise associated with pile driving and vessels are discussed above. The following considers the effects of common noise-producing activities resulting from the proposed action.

Machinery Noise

Machinery noise generated during the operation of fixed structures can be continuous or transient, and variable in intensity. Underwater noise from fixed structures ranges from about 20 to 40 decibels (dB) above background levels within a frequency spectrum of 30-300 Hz at a distance of 30 m from the source (Gales 1982). These levels vary with type of platform and water depth. Underwater noise from platforms standing on metal legs would be expected to be insignificant of the small surface area in contact with the water and the placement of machinery on decks well above the water.

Drilling

Offshore drilling and production involves a variety of activities that produce underwater noises. Noises emanating from drilling activities from fixed, metal-legged platforms are considered not very intense and generally are at very low frequencies; near 5 Hz. Gales (1982) reported received levels of 119 to 127 dB re 1 μPa-m at near-field measurements. Noises from semi-submersible platforms also show rather low sound source levels. Drillships show somewhat higher noise levels than semi-submersibles as a result of mechanical noises generated through the drillship hull. The drillship Canmar Explorer II generates broadband source levels of 174 dB re 1 μPa-m. Noises associated with offshore oil and gas production are generally weak and typically at very low frequencies (~4.5 to 38 Hz) (Gales 1982). Although drilling noise may contribute to increases in ambient noise levels in the GOM while these activities are occurring, based on the available information, drilling is not expected to produce amplitudes sufficient to case hearing or behavioral effects in sea turtles or sperm whales; therefore, these effects are insignificant.

3.1.8 Pipeline Construction Effects on Sea Turtles and Gulf Sturgeon

The conventional construction season for pipeline installation is spring through fall (MMS 2006). Although sea turtles could be found in a pipeline construction area any time of year, potential impacts to Gulf sturgeon would be avoided during this construction period when Gulf sturgeon are found in riverine habitats. However, since this analysis is based upon anticipated activities in the future and the time of year of pipeline construction is unknown, it is assumed construction may occur any time. Construction of offshore pipelines will result in turbidity from burying of the pipeline as it is deployed by one barge as a second barge cuts (jets) the trenches and buries the pipeline. Sediment disturbance may also occur from jetting and trenching of the seafloor to lay the pipeline. The effects of turbidity are not expected to result in adverse impacts to listed species and are considered discountable. Any potential disturbance would be associated with short-term avoidance of the construction area. Any avoidance behavior that may occur is not expected to result in any detectable change in the foraging success or health of individuals. Sea turtles and Gulf sturgeon that may be in the area of pipeline installation or resting on the seafloor may experience temporary displacement from the area. Any disturbances to listed sea turtle species are expected to be insignificant, having no adverse impacts on listed species of sea turtles or Gulf sturgeon.

Pipelines installed in water depths greater than 500 m use dynamically positioned barges that do not require anchoring to the sea floor or burying of the pipeline. Construction of pipelines is not expected to affect sperm whales, and the potential effects of vessel operations on listed species are discussed above.

3.1.9 Brightly-lit platforms

Lighting of offshore structures presents a potential danger to sea turtle hatchlings (Owens 1983). Artificial lighting is a known threat to nesting sea turtles and interrupts the ocean-finding behavior of neonates. Hatchlings are known to be attracted to light (Witherington and Martin 1996, Witherington 1997). Platform lighting near nesting beaches could potentially affect nesting sea turtles and affect the behavior during the offshore migration of neonates if the structures are close to shore (Chan and Liew 1988). If this occurs, hatchling predation would increase dramatically since large birds and predacious fish also congregate around the platforms (Owens 1983, Witherington and Martin 1996). However, hatchlings may rely less on light cues offshore (Salmon and Wyneken 1990). Furthermore, attraction to offshore locations would be less problematic than attraction to landside locations, as the issue is to ensure that hatchlings head to sea rather than remaining onshore, or swimming parallel to shore where they are subject to a variety of mortality risks. Due to the location of MMS-permitted structures on the OCS, the effects of lighting from offshore structures on sea turtles are insignificant.

3.1.10 Heavy Metals

The environmental risks of chemical products used in GOM oil and gas operations have been analyzed and continue to be studied. Produced waters, drill muds, and drill cuttings are routinely discharged into offshore marine waters and are regulated by the U.S. Environmental Protection Agency's (USEPA) National Pollutant and Discharge Elimination System permits. Most of the routinely discharged chemicals are diluted and dispersed when released in offshore areas and are not expected to directly affect any listed species. Accidental or intentional discharges of chemicals have the potential to be released in large volumes that may have deleterious short-term effects (hours to days) within the immediate marine environment. When an area is drilled, drilling fluids, drill cuttings, produced water, deck drainage, sanitary wastes, and domestic wastes are released. During production, additional waste streams include produced sand and well treatment, workover, and completion fluids. Minor discharges are also released from desalination units, blowout preventer fluids, boiler blowdown, and excess cement slurry.

The chemical profiles, toxicity, and spill analyses have been summarized for some chemical compounds used for development and production and are detailed in MMS 2001a and 2001b. The Lethal Concentration 50 (LC50), Effect Concentration 50 (EC50), and Lowest Observed Effect Concentration (LOEC) of these chemicals have been determined for algae, invertebrates, fish, and benthic organisms. Existing data show that heavy metal concentrations are often present in marine mammal and sea turtle tissues and organs from different locations around the world's oceans. These heavy metals are also detected in eggs and hatchling sea turtles, as well as in the milk of lactating cetaceans. Neff (2002) provides a review of bioaccumulation in marine organisms and the effects of contaminants in oil well produced water.

A comprehensive review of the wastes and pollutants generated by oil and gas activities and their toxicity to selected marine organisms may be found in NPDES evaluation criteria (USEPA 1993a, 1993b). Results of analysis conducted by Neff et al. (1989) looked at the accumulation of mercury and other metals in flounder, clams, and sand worms. Flounder did not accumulate any metals during exposure, and the soft-shell clams and sand worms had only slight increases of some metals. The authors noted that most of the accumulated metals were actually in the gut or gills as barite particles. These investigations led the researchers to conclude that metals associated with drilling fluid barite are not readily available by uptake from marine organisms.

The quantitatively most important sources of mercury from exploration and production activities are drilling fluids and produced water. GOM-produced water rarely contains more than about 0.1 mg/L total mercury (about 10-fold higher than clean natural seawater). Nearly all the mercury in drilling muds is associated with barite, which is added to the mud as a weighting agent. The USEPA limit on mercury in barite is 1 part per million (ppm). The average mercury concentration in modern drilling mud barite is 0.5 ppm. Most drilling muds and cuttings contain <0.1 ppm mercury. The mercury in produced water is diluted rapidly to background concentrations following discharge to the ocean. Most drilling muds discharged to US waters contain <1 ppm mercury. Sediments around offshore platforms in the GOM also rarely contain more than 1 ppm mercury. The background concentration of mercury in marine sediments from the GOM is usually <0.1 ppm.

The mercury in drilling mud barite is sequestered in the solid barium sulfate in sulfide minerals, particularly sphelerite (ZnS). It is extremely insoluble and stable in this form, particularly in anoxic sediments. Very little mercury can be extracted from the barite, even under mildly acidic conditions, as might occur in the digestive tract of a marine animal. Because of its low bioavailability, mercury in barite is not readily available for methylation, and has consequently been shown to not be readily available in the food chain.

Drilling fluids also contain barium and trace amounts of chromium, copper, cadmium, mercury, lead, and zinc. Chronic levels of these metals are localized to within 150 m of drilling structures (Kennicutt 1995). Statistically significant levels (when compared to background levels) of all these metals except chromium have been measured within 500 m of GOM drilling sites (Boothe and Presley 1989), and dilution to background levels occurs within 1,000 m of the discharge point.

Although elevated levels of mercury may occur within 500 m of drilling sites (Kennicutt 1995), the chemical composition of the mercury in barite is not readily available to biological organisms (Neff et al. 1989). Data for mercury in tissues of fish and shellfish from the GOM show that marine animals collected near offshore platforms do not contain significantly higher concentrations of mercury than the same or related species from elsewhere in the GOM. Although there is some localized heavy metal contamination within 150 m of drilling sites, it is not expected to adversely affect larger, wide-ranging species such as sea turtles and sperm whales. No MMS-permitted oil and gas drilling occurs in or near Gulf sturgeon habitat, and no effects on this species or its designated critical habitat is expected, and not considered further in this biological opinion.

3.1.11 Water Quality

The main sources of wastes and discharges generated from oil and gas operations include treated sewage, treated wastewater, engine waste, biodegradable food waste, and solid waste. Wastes and discharges will result from operation of offshore structures and support vessels. Due to standard practices of the presence of curbs, drip pans, and other pollution prevention equipment on offshore structures, we believe the routine discharges of treated sewage, wastewater, and biodegradable food wastes will not adversely affect listed species of sea turtles, Gulf sturgeon, or sperm whales.

Turbidity could result from construction activities, including pipelines, anchoring, and pile driving. The amount of turbidity from these type of activities is generally localized and short-term in duration. Listed species in any construction area may experience temporary displacement from the area, yet minor disturbance, if any, is expected to occur. Any disturbances to sea turtle, Gulf sturgeon, or sperm whales from turbidity are expected to be short term and insignificant, having no adverse impacts on these species.

Some additional sources of turbidity may be associated with the anchoring of tugboats used in the GBS installation, placement of the GBS on the seafloor, and the installation of other LNG terminal components (e.g., steel jacket, mooring structures, and pipeline riser platform). All these effects are expected to result in minimal disturbance of the seafloor and any turbidity would be expected to have short term, minor effects on water quality. Insignificant effects to listed species are expected from these short-term increases in turbidity.

Summary of Potential Adverse Effects to Listed Species
In summary, NMFS concludes green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles; and Gulf sturgeon are not likely to be adversely affected by the above effects associated with the proposed action; however, the effects of vessel strikes on sea turtles, and the effects of oil spills on all listed species in the action area are considered further in the Effects of the Action in Section 7 of this biological opinion.

4 CRITICAL HABITAT LIKELY TO BE AFFECTED

Gulf sturgeon critical habitat was jointly designated by NMFS and USFWS on April 18, 2003 (50 CFR 226.214). Critical habitat is defined in section 3(5)(A) of the ESA as (i) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. "Conservation" is defined in section 3(3) of the ESA as the use of all methods and procedures that are necessary to bring any endangered or threatened species to the point at which listing under the ESA is no longer necessary.

Gulf sturgeon critical habitat includes areas within the major river systems that support the seven currently reproducing subpopulations (USFWS et al. 1995) and associated estuarine and marine habitats. Gulf sturgeon use the rivers for spawning, larval and juvenile feeding, adult resting and staging, and to move between the areas that support these components. Gulf sturgeon use the lower riverine, estuarine, and marine environments during winter months primarily for feeding and, more rarely, for inter-river migrations. Estuaries and bays adjacent to the riverine units provide unobstructed passage of sturgeon from feeding areas to spawning grounds.

Fourteen areas (units) are designated as Gulf sturgeon critical habitat. Critical habitat units encompass approximately 2,783 river kilometers (km) and 6,042 km^2 of estuarine and marine habitats and include portions of the following GOM rivers, tributaries, estuarine, and marine areas:

Unit 1 = Pearl and Bogue Chitto Rivers in Louisiana and Mississippi
Unit 2 = Pascagoula, Leaf, Bowie, Big Black Creek and Chickasawhay Rivers in Mississippi
Unit 3 = Escambia, Conecuh, and Sepulga Rivers in Alabama and Florida
Unit 4 = Yellow, Blackwater, and Shoal Rivers in Alabama and Florida
Unit 5 = Choctawhatchee and Pea Rivers in Florida and Alabama
Unit 6 = Apalachicola and Brothers Rivers in Florida
Unit 7 = Suwannee and Withlacoochee Rivers in Florida
Unit 8 = Lake Pontchartrain (east of causeway), Lake Catherine, Little Lake, the Rigolets, Lake Borgne, Pascagoula Bay and Mississippi Sound systems in Louisiana and Mississippi, and sections of the state waters within the GOM

Unit 9 = Pensacola Bay system in Florida
Unit 10 = Santa Rosa Sound in Florida
Unit 11 = Nearshore GOM in Florida
Unit 12 = Choctawhatchee Bay system in Florida
Unit 13 = Apalachicola Bay system in Florida, and
Unit 14 = Suwannee Sound in Florida

Critical habitat determinations focus on those physical and biological features, or primary constituent elements (PCEs), that are essential to the conservation of the species (50 CFR 424.12). Federal agencies must insure that their activities are not likely to result in the destruction or adverse modification of the PCEs within defined critical habitats. Therefore, proposed actions that may impact designated critical habitat require an analysis of potential impacts to each PCE.

PCEs identified as essential for the conservation of the Gulf sturgeon consist of:

(1) Abundant food items, such as detritus, aquatic insects, worms, and/ or molluscs, within riverine habitats for larval and juvenile life stages; and abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, molluscs and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages;

(2) Riverine spawning sites with substrates suitable for egg deposition and development, such as limestone outcrops and cut limestone banks, bedrock, large gravel or cobble beds, marl, soapstone, or hard clay;

(3) Riverine aggregation areas, also referred to as resting, holding, and staging areas, used by adult, subadult, and/or juveniles, generally, but not always, located in holes below normal riverbed depths, believed necessary for minimizing energy expenditures during fresh water residency and possibly for osmoregulatory functions;

(4) A flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) necessary for normal behavior, growth, and survival of all life stages in the riverine environment, including migration, breeding site selection, courtship, egg fertilization, resting, and staging, and for maintaining spawning sites in suitable condition for egg attachment, egg sheltering, resting, and larval staging;

(5) Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;

(6) Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and

(7) Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., an unobstructed river or a dammed river that still allows for passage).

As stated in the final rule designating Gulf sturgeon critical habitat (68 FR 13399), the following activities, among others, when authorized, funded or carried out by a federal agency, may destroy or adversely modify critical habitat:

(1) Actions that would appreciably reduce the abundance of riverine prey for larval and juvenile sturgeon, or of estuarine and marine prey for juvenile and adult Gulf sturgeon, within a designated critical habitat unit, such as dredging; dredged material disposal; channelization; in-stream mining; and land uses that cause excessive turbidity or sedimentation;

(2) Actions that would appreciably reduce the suitability of Gulf sturgeon spawning sites for egg deposition and development within a designated critical habitat unit, such as impoundment; hard-bottom removal for navigation channel deepening; dredged material disposal; in-stream mining; and land uses that cause excessive sedimentation;

(3) Actions that would appreciably reduce the suitability of Gulf sturgeon riverine aggregation areas, also referred to as resting, holding, and staging areas, used by adult, subadult, and/or juveniles, believed necessary for minimizing energy expenditures and possibly for osmoregulatory functions, such as dredged material disposal upstream or directly within such areas; and other land uses that cause excessive sedimentation;

(4) Actions that would alter the flow regime (the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) of a riverine critical habitat unit such that it is appreciably impaired for the purposes of Gulf sturgeon migration, resting, staging, breeding site selection, courtship, egg fertilization, egg deposition, and egg development, such as impoundment; water diversion; and dam operations;

(5) Actions that would alter water quality within a designated critical habitat unit, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, such that it is appreciably impaired for normal Gulf sturgeon behavior, reproduction, growth, or viability, such as dredging; dredged material disposal;

channelization; impoundment; in-stream mining; water diversion; dam operations; land uses that cause excessive turbidity; and release of chemicals, biological pollutants, or heated effluents into surface water or connected groundwater via point sources or dispersed non-point sources;

(6) Actions that would alter sediment quality within a designated critical habitat unit such that it is appreciably impaired for normal Gulf sturgeon behavior, reproduction, growth, or viability, such as dredged material disposal; channelization; impoundment; in-stream mining; land uses that cause excessive sedimentation; and release of chemical or biological pollutants that accumulate in sediments; and

(7) Actions that would obstruct migratory pathways within and between adjacent riverine, estuarine, and marine critical habitat units, such as dams, dredging, point-source-pollutant discharges, and other physical or chemical alterations of channels and passes that restrict Gulf sturgeon movement.

4.1 Effects to Critical Habitat Considered and Discounted

Gulf sturgeon critical habitat was designated in 2003 (50 CFR 226.214). Federal agencies must insure that their activities are not likely to result in the destruction or adverse modification of designated critical habitat through adverse effects to the primary constituent elements (PCEs) within defined critical habitats. The seaward boundary of Louisiana, Mississippi, and Alabama state coastal zones is 3 nautical miles into the territorial sea. Since Gulf sturgeon critical habitat extends only 1 mile beyond the barrier islands, it is fully within State waters. MMS lease sale activities primarily occur offshore and would not be expected to directly affect designated critical habitat for the Gulf sturgeon. However, pipelines and accidental spills were considered and discounted for their potential to adversely affect designated critical habitat.

4.1.1 Pipelines

Various entities regulate pipeline and other activity in State waters with either the COE or the Federal Energy Regulatory Commission (FERC) as the lead federal agency responsible for permitting such activities. Pipeline construction is therefore considered an indirect effect of the proposed action. If a pipeline were to be constructed through designated critical habitat for Gulf sturgeon, pipeline projects would have individual permits associated with them and would be subject to section 7 consultation under the ESA with FERC at that time.

Increasingly, the trend is for new OCS pipelines to tie into existing systems rather than creating new landfalls. Over the last 10 years, there has been an average of about one new OCS pipeline-making landfall per year. Since 2002, only one new pipeline has come to shore in Louisiana from OCS-related activities, but none have been constructed in designated Gulf sturgeon critical habitat since its designation that have been a result of MMS actions. Based on this trend, few if any pipelines are expected to affect Gulf sturgeon critical habitat. However, considering the duration of proposed action, between the years 2007 and 2046, 80-118 new pipelines are projected in state waters as a result of the OCS Program. Of those pipelines, 32-47 (25-36 in Louisiana, 1-3 in Mississippi and/or Alabama) are projected to make landfall. Any pipelines that make landfall would most likely go ashore in Plaquemines Parish, Louisiana; Jackson County, Mississippi; or Mobile County, Alabama. Landfalls in Plaquemines Parish, Louisiana are not expected to affect critical habitat. However, the estimated three pipelines making landfall in Mississippi and Alabama may affect designated critical habitat unit 8. Currently, no pipelines are currently planned for construction in designated critical habitat; therefore, the following analysis is based upon the best available information for this type of activity with the expectation that a few pipelines may be constructed in designated critical habitat unit 8 over the 40-year lifetime of the action.

Of the seven PCEs of Gulf sturgeon critical habitat discussed above, four are found in critical habitat unit 8: 1) abundant food items; 2) water quality; 3) sediment quality; and 4) migratory pathways. The following PCEs were considered, and discounted for the potential to be adversely affected by the proposed lease sales: water quality, migratory pathways, and sediment quality.

Abundant Food Items
It is assumed that 0.32 ha of bottom is disturbed per kilometer of pipeline installed (MMS 2006). Benthic organisms could be displaced or buried during jetting, trenching, and burial of pipelines. Because the pipeline is expected to be buried at a depth of 1 m in this area and the amount of material side-cast to create the trench is expect to range several inches in depth, invertebrates are expected to be able to recolonize the area by burrowing and/or tunneling back to the sediment depths in which they are usually found. The side-casting of the material resulting from trenching and jetting is expected to be minor and insignificant since the invertebrates will be covered with a relatively shallow amount of sediment and the effects are expected to be short-term and insignificant. Following laying of pipelines in water depths <60 m, they are required to be buried. Pipelines are required to be buried at a minimum depth of 1 m and invertebrates will be able to colonize these sediments following burial, and will be available to foraging Gulf sturgeon. The impacted areas from the potential three pipelines would be expected to affect a very small percentage of the total area of unit 8. The impacts are expected to be temporary and not significantly affect the available foraging habitat in unit 8 while the impacts last.

Anchoring of barges is usually required during construction of the pipeline. Anchor depressions can be as deep as 2.1 to 2.8 m. Each time an anchor is relocated, sediments and benthic organisms beneath the anchor would be displaced, suspended, or crushed. Anchoring methods are designed to minimize movement and sweeping of anchor chains; therefore, impacts are expected to be minimal. The areas affected would be available for recolonization of invertebrate fauna following anchor removal. The effects to invertebrates are expected to be temporary and insignificant.

Potential pipeline leaks were also considered for the potential to affect abundant prey items, sediment quality, and water quality. Because natural gas would bubble to the surface and dissipate, no impacts to Gulf sturgeon critical habitat PCEs would be expected.

Water Quality
The disturbance of approximate 0.32 ha of bottom per kilometer of pipeline installed (MMS 2006) may affect water quality in the Gulf sturgeon critical habitat. Sediments would be suspended resulting in increased turbidity and a short-term degradation of water quality. The turbidity is expected to last from hours to days depending on the amount of sediment suspended. During jetting and trenching, and anchor placement, some turbidity is expected to occur. No changes in temperature, salinity, pH, hardness, oxygen content, or other chemical characteristics are expected from pipeline construction. NMFS does not expect measurable impacts to the status of this PCE, as a result of this project, within unit 8 or designated Gulf sturgeon critical habitat overall.

Sediment Quality
Sediment contaminants were considered for their potential to be suspended and settle during construction operations. The (USEPA) has assessed the overall condition of GOM estuaries (USEPA 1999). Based on this assessment, the USEPA concluded that there was an even distribution of estuary sites between the Florida panhandle and Corpus Christi, Texas, whose sediments were contaminated. However, the majority of estuarine ecosystems in all GOM states were identified as having fair to good sediment quality.

Trenching and jetting will be used to lay the pipeline. Coarse sediment will settle out quickly (hours), while finer sediments may remain suspended for longer periods (hours to days). Because the depth of disturbance is rather shallow (the pipeline will be buried at a depth of 1 m), the quality of sediment settling out on the seafloor is expected to be the same as pre-disturbance conditions.

Based on the available information regarding contaminants and depth of sediment disturbance, no adverse affects to sediment quality are expected from pipeline construction.

Migratory Pathways
Effects on migratory pathways of Gulf sturgeon critical habitat unit 8 were considered during consultation on this project. Because pipeline construction generally occurs in open waters of the GOM and will involve the localized disturbances related to the immediate area of pipe-laying activities, NMFS believes that the project will not reduce or eliminate Gulf sturgeon access to areas nearby or adjacent to the immediate project site. Therefore, pipeline construction is not expected to adversely affect migratory pathways.

4.1.2 Accidental Spills
Potential impacts on designated Gulf sturgeon critical habitat may occur from drilling and produced water discharges, accidental releases of fluids, blowouts, and oil spills.

Designated critical habitat units 8 and 9 were considered in this analysis. If a spill were to contact Gulf sturgeon critical habitat, the PCEs of water quality, sediment quality, and abundant prey items may be affected. Coastal areas are generally more susceptible to contact by inshore or coastal spills. Inshore spills have a low probability of occurrence. Inshore vessel collisions may release fuel and lubricant oils and pipeline ruptures may release crude and condensate oil and may infrequently occur. Because of the floating nature of oil and the small tidal range in the coastal GOM, oil spills alone would typically have very little impact on benthic feeders such as the Gulf sturgeon. Unusually low tidal events, increased wave energy, or the use of oil dispersants increase the risk of impact with bottom-feeding and/or bottom-dwelling fauna. For this reason, dispersants are not usually used in response to coastal spills. Dispersants would likely be used for offshore spills and are expected to disperse about 65 percent of the volume of a spill. Additionally, considering the projected use of shore bases in support of activities resulting from a proposed action, very few of the estimated 46-102 coastal spills resulting from a proposed action in the CPA are likely to occur east of the Mississippi River. No coastal spills are projected to occur in Mississippi, Alabama, or Florida coastal waters as a result of a proposed action in the CPA. NMFS believes that the risk from inshore spills reaching Gulf sturgeon designated critical habitat and affecting any PCEs is so low, it is discountable.

Offshore spills are generally far less likely to affect designated critical habitat than inshore or coastal spills because much of the critical habitat is protected from offshore spills by barrier islands, shoals, shorelines, and currents. Smaller spills (<42,000 gal) are not expected to significantly impact water quality in marine and coastal waters. The dilution and low toxicity of this pollution from small spills offshore are not expected to reach any designated critical habitat and is considered discountable. Larger spills, however, could impact coastal waters, depending on many factors such as the buoyancy of the spilled fluid, distance from the spill, currents, and duration of the spill.

The potential risk of an oil spill affecting Gulf sturgeon critical habitat must be evaluated before the potential affects to PCEs can be assessed. Several factors reduce the probability of spilled oil affecting Gulf sturgeon critical habitat, including:

- The inshore, riverine areas of designated habitat have a negligible probability of impact from accidental oil spills due to geographic protection, location east of the Mississippi River, and distance from major shore bases;
- The floating nature of oil and the lack of large tidal ranges, as well as the influence of the Mississippi River outflow to help disperse slicks, diminishes the probability of significant impact of spilled oil on Gulf sturgeon critical habitat;
- The very low probability (1 percent or less) of a large offshore oil spill contacting Gulf sturgeon critical habitat in all but the very westernmost area diminishes potential impact to, or alteration of, critical habitat; and
- The extremely low probability of a coastal spill impacting east of the Mississippi River and north of Plaquemines Parish diminishes the probability of oil impacts to critical habitat.

Based on oil spill modeling conducted by MMS, the coastal waters inhabited by the Gulf sturgeon are not expected to be at any significant risk from oil spills. The likelihood of a spill >42,000 gal occurring within the WPA and reaching designated critical habitat within 10 days after the spill incident is <0.5 percent and considered discountable (Table 4). Very few of the estimated 46-102 coastal spills resulting from a proposed action in the CPA are likely to occur east of the Mississippi River. No coastal spills are projected to occur in Mississippi, Alabama, or Florida coastal waters as a result of a proposed action in the CPA. However, MMS conducted an analysis of the risk of a spill >42,000 gal occurring offshore as a result of a proposed action and reaching the known locations of the Gulf sturgeon within 10 days after the spill event. It is estimated that there is a 1 percent risk for Louisiana waters east of the Mississippi River to be affected by an oil slick within 10 days. Probabilities decrease below 1 percent to areas further to the east.

Table 4. Probability (% chance) of oil spills ≥42,000 gal occurring and contacting designated Gulf sturgeon critical habitat within 10 days as a result of a WPA or CPA proposed action ("high" and "low" refer to production levels).

Critical Habitat Unit	WPA		CPA	
	Low	High	Low	High
8	**<0.5**	**<0.5**	**1**	**1**
9	**<0.5**	**<0.5**	**<0.5**	**<0.5**

Based on the above analysis, the likelihood of spill occurrence and subsequent contact with Gulf sturgeon designated critical habitat is extremely low; therefore the potential affect to any PCE is considered discountable.

Summary of Effects to PCEs

In summary, the PCEs of abundant prey items, water quality, sediment quality, and migratory pathways are not likely to be adversely affected by pipelines construction or accidental spills associated with the proposed action. The probability of an oil or chemical spill reaching designated Gulf sturgeon critical habitat is so low, it is considered discountable.

5 STATUS OF AFFECTED SPECIES IN THE ACTION AREA

The sea turtle subsections focus primarily on the Atlantic Ocean populations of these species since these are the populations that may be directly affected by the proposed action. However, these species are listed as global populations (with the exception of Kemp's ridley and Florida green sea turtles, whose distribution is entirely in the Atlantic including the GOM), and the global status and trends of these species are included as well, in order to provide a basis for our final determination of the effects of the proposed action on the species as listed under the ESA.

5.1 Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. In the Atlantic, developmental habitat for small juveniles is the pelagic waters of the North Atlantic and the Mediterranean Sea (NMFS and USFWS, 1991a). Within the continental United States, loggerhead sea turtles nest from Texas to New Jersey. Major nesting areas include coastal islands of Georgia, South Carolina, and North Carolina, and the Atlantic and GOM coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida.

5.1.1 Pacific Ocean

In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. Within the Pacific Ocean, loggerhead sea turtles are represented by a northwestern nesting aggregation located in Japan and a smaller southwestern nesting aggregation, which occurs in eastern Australia (Great Barrier Reef and Queensland) and New Caledonia (NMFS 2001a). There are no reported loggerhead nesting sites in the eastern or central Pacific Ocean basin. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead turtles (Bolten et al. 1996). Recent genetic analyses on female loggerheads nesting in Japan suggest that this "subpopulation" is comprised of genetically distinct nesting colonies (Hatase et al. 2002) with precise natal homing of individual females. As a result, Hatase et al. (2002) indicate that loss of one of these colonies would decrease the genetic diversity of Japanese loggerheads; recolonization of the site would not be expected on an ecological time scale. In Australia, long-term census data has been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting populations since the mid-1980s (Limpus and Limpus 2003). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

Pacific loggerhead turtles are captured, injured, or killed in numerous Pacific fisheries including Japanese longline fisheries in the western Pacific Ocean and South China Seas; direct harvest and commercial fisheries off Baja California, Mexico; commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries. In addition, the abundance of loggerhead turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Loggerhead turtle colonies in the western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (e.g., due to egg poaching).

5.1.2 Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are at least five western Atlantic subpopulations, divided geographically as follows: (1) A northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29°N; (2) a south Florida nesting subpopulation, occurring from 29oN on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990, TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001a). The fidelity of nesting females to their nesting beach is the reason these subpopulations can be differentiated from one another. Fidelity for nesting beaches makes recolonization of nesting beaches with sea turtles from other subpopulations unlikely.

Life History and Distribution

Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985, Frazer et al. 1994), with the benthic immature stage lasting at least 10-25 years. However, based on data from tag returns, strandings, and nesting surveys (NMFS 2001a), NMFS estimates ages of maturity ranging from 20-38 years with the benthic immature stage lasting from 14-32 years.

Mating takes place in late March through early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic and GOM, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in Northeastern Mexico.

Tagging studies have shown loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year round in offshore waters off North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly et al. 1995a, Epperly et al. 1995b, Epperly et al. 1995c), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some may remain in mid-Atlantic and Northeast areas until late fall. By December loggerheads have emigrated from inshore

North Carolina waters and coastal waters to the north to waters offshore North Carolina, particularly off Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles ($\geq$11°C) (Epperly et al. 1995a, Epperly et al. 1995b, Epperly et al. 1995c). Loggerhead sea turtles are year-round residents of central and south Florida.

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Population Dynamics and Status

A number of stock assessments (TEWG 1998, TEWG 2000, NMFS 2001a, Heppell et al. 2003) have examined the stock status of loggerheads in the waters of the United States, but have been unable to develop any reliable estimates of absolute population size. Based on nesting data of the five western Atlantic subpopulations, the south Florida-nesting and the northern-nesting subpopulations are the most abundant (TEWG 2000, NMFS 2001a). Between 1989 and 1998, the total number of nests laid along the U.S. Atlantic and Gulf coasts ranged from 53,014 to 92,182, annually with a mean of 73,751 (TEWG 2000). On average, 90.7 percent of these nests were of the south Florida subpopulation and 8.5 percent were from the northern subpopulation (TEWG 2000). The TEWG (2000) assessment of the status of these two better-studied populations concluded that the south Florida subpopulation was increasing at that time, while no trend was evident (may be stable but possibly declining) for the northern subpopulation. A more recent, yet-to-be-published analysis of nesting data from 1989-2005 by the Florida Wildlife Research Institute indicates there is a declining trend in nesting at beaches utilized by the south Florida nesting subpopulation (2006 FWRI letter (McRae) to NMFS, based on statewide nesting beach survey data analyzed by FWRI). Nesting data obtained for the 2006 nesting season is also consistent with the decline in loggerhead nests (Meylan pers. comm. 2006). It is unclear at this time whether the nesting decline reflects a decline in population, or is indicative of a failure to nest by the reproductively mature females as a result of other factors (resource depletion, nesting beach problems, oceanographic conditions, etc.). NMFS has convened a new Turtle Expert Working Group for loggerhead sea turtles that will gather available data and examine the potential causes of the nesting decline and what the decline means in terms of population status. A final report by the loggerhead TEWG is expected by the end of summer 2007.

For the northern subpopulations, recent estimates of loggerhead nesting trends in Georgia from standardized daily beach surveys showed significant declines ranging from 1.5 to 1.9 percent annually (Mark Dodd, Georgia Department of Natural Resources, pers. comm., 2006). Nest totals from aerial surveys conducted by the South Carolina Department of Natural Resources showed a 3.3 percent annual decline in nesting since 1980. Another consideration that may add to the importance and vulnerability of the northern subpopulation is the sex ratios of this subpopulation. NMFS scientists have estimated that the northern subpopulation produces 65 percent males (NMFS 2001a). However, new research conducted over a limited time frame has found opposing sex ratios (Wyneken et al. 2004) so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The remaining three subpopulations – Dry Tortugas, Florida Panhandle, and Yucatán – are much smaller, but also relevant to the continued existence of the species. Nesting surveys for the Dry Tortugas subpopulation are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2003 (although the 2002 year was missed). Nest counts ranged from 168-270 but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data). Nest counts for the Florida Panhandle subpopulation are focused on index beaches rather than all beaches where nesting occurs. Currently, there is not enough information to detect a trend for the subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Index Nesting Beach Survey Database). Similarly, nesting survey effort has been inconsistent among the Yucatán nesting beaches and no trend can be determined for this subpopulation. However, there is some optimistic news. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico, from 1987-2001 where survey effort was consistent during the period.

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). Also, many nests were destroyed during the 2004 hurricane season. Other sources of natural mortality include cold stunning and biotoxin exposure.

Anthropogenic factors that impact hatchlings and adult female turtles on land, or the success of nesting and hatching include: beach erosion, beach armoring and nourishment, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, beach driving, coastal construction and fishing piers, exotic dune and beach vegetation, and poaching. An increase in human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g., raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (e.g., Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation, marine pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the Atlantic highly migratory species (HMS) pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea (Aguilar et al. 1995, Bolten et al. 1996). Loggerheads in the benthic environment in waters off the coastal United States are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook and line, gillnet, pound net, longline, and trap fisheries (see further discussion in Section 4.2, Environmental Baseline).

5.1.3 Summary of Status for Loggerhead Sea Turtles

The abundance of loggerhead turtles on nesting beaches throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead turtles (Bolten et al. 1996), but it has probably declined since 1995 and continues to decline (Tillman 2000). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. NMFS recognizes five subpopulations of loggerhead sea turtles in the western north Atlantic based on genetic studies. Cohorts from all of these are known to occur within the action area of this consultation. The South Florida subpopulation may be critical to the survival of the species in the Atlantic Ocean because of its size (over 90 percent of all U.S. loggerhead nests are from this subpopulation). In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989, NMFS and USFWS 1991a). However, the status of the Oman colony has not been evaluated recently and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan et al. 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown.

All loggerhead subpopulations are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur as a result of activities outside of U.S. jurisdiction (i.e., fisheries in international waters).

5.2 Green Sea Turtle

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are endangered. The nesting range of the green sea turtles in the southeastern United States includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina, the U.S. Virgin Islands (USVI) and Puerto Rico (NMFS and USFWS 1991b). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties (Ehrhart and Witherington 1992). Green sea turtle nesting also occurs regularly on St. Croix, USVI, and on Vieques, Culebra, Mona, and the main island of Puerto Rico (Mackay and Rebholz 1996).

5.2.1 Pacific Ocean

Green turtles are thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, from a combination of overexploitation and habitat loss (Seminoff 2002). In the western Pacific, the only major (>2,000 nesting females) populations of green turtles occur in Australia and Malaysia, with smaller colonies throughout the area. Indonesia has a widespread distribution of green turtles, but has experienced large declines over the past 50 years. Hawaii green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al., 1998 in Balazs and Chaloupka 2003). In the eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacan, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). There is also sporadic green turtle nesting along the Pacific coast of Costa Rica.

5.2.2 Atlantic Ocean

Life History and Distribution

The estimated age at sexual maturity for green sea turtles is between 20-50 years (Balazs 1982, Frazer and Ehrhart 1985). Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, whereas males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal 1997).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Green sea turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses. This includes areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997, NMFS and USFWS 1991b). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984, Hildebrand 1982, Shaver 1994), the GOM off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957, Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon System, Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Population Dynamics and Status

The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). Green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Current nesting levels in Florida are reduced compared to historical levels, reported by Dodd (1981). However, total nest counts and trends at index beach sites during the past decade suggest the numbers of green sea turtles that nest within the southeastern United States are increasing.

Although nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle's life is spent on the foraging and developmental grounds. Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean Coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1997). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997).

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast of Florida) show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2002).

It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero. Trends at Florida beaches were previously discussed. Trends in nesting at Yucatán beaches cannot be assessed because of a lack of consistent beach surveys over time. Trends at Tortuguero (ca. 20,000-50,000 nests/year) showed a significant increase in nesting during the period 1971-1996 (Bjorndal et al. 1999), and more recent information continues to show increasing nest counts (Troëng and Rankin 2004). Therefore, it seems reasonable that there is an increase in immature green sea turtles inhabiting coastal areas of the southeastern United States; however, the magnitude of this increase is unknown.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the over-exploitation of green sea turtles for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the United States. These threats include beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities, and interactions with fishing gear. Sea sampling coverage in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. There is also the increasing threat from green sea turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994, Jacobson, 1990, Jacobson et al. 1991).

5.2.3 Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the GOM and Caribbean, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many of the same natural and anthropogenic threats as for loggerhead sea turtles described above. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Recent population estimates for the western Atlantic area are not available. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring since establishment of index beaches in Florida in 1989. However, given the species' late sexual maturity, caution is warranted about over-interpreting nesting trend data collected for less than 15 years.

5.3 Kemp's Ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley has been considered the most endangered sea turtle (Zwinenberg 1977, TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. This species occurs mainly in coastal areas of the GOM and the northwestern Atlantic Ocean. Occasional individuals reach European waters

(Brongersma 1972). Adults of this species are usually confined to the GOM, although adult-sized individuals sometimes are found on the east coast of the United States.

5.3.1 Atlantic Ocean

Life History and Distribution

The TEWG (1998) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western GOM, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Little is known of the movements of the post-hatchling stage (pelagic stage) within the GOM. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). Benthic immature Kemp's ridleys have been found along the eastern seaboard of the United States and in the GOM. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). Studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern GOM until cooling waters force them offshore or south along the Florida coast (Renaud 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). Pelagic stage Kemp's ridleys presumably feed on the available Sargassum and associated infauna or other epipelagic species found in the GOM.

Population Dynamics and Status

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s nest numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting with 6,277 nests recorded in 2000, 10,000 nests in 2005, and 12,143 nests recorded during the 2006 nesting season (Gladys Porter Zoo nesting database) show the decline in the ridley population has stopped and the population is now increasing.

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimping fleets and Mexican beach protection efforts. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by

TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

Next to loggerheads, Kemp's ridleys are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June (Keinath et al. 1987, Musick and Limpus 1997). The juvenile population of Kemp's ridley sea turtles in Chesapeake Bay is estimated to be 211 to 1,083 turtles (Musick and Limpus 1997). These juveniles frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Kemp's ridleys consume a variety of crab species, including Callinectes spp., Ovalipes spp., Libinia sp., and Cancer spp. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Upon leaving Chesapeake Bay in autumn, juvenile ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds, as well as smaller juveniles from New York and New England, to form one of the densest concentrations of Kemp's ridleys outside of the GOM (Musick and Limpus 1997, Epperly et al. 1995a, Epperly et al. 1995b).

Threats

Kemp's ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green turtles were found on Cape Cod beaches (R. Prescott, pers. comm. 2001). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold-stunning events may be associated with numbers of turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Many cold-stunned turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality.

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed above. For example, in the spring of 2000, five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The five ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

5.3.2 Summary of Kemp's Ridley Status

The only major nesting site for ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999.

Current totals are 12,059 nests in Mexico in 2006 (August 8, 2006, e-mail from Luis Jaime Peña - Conservation Biologist, Gladys Porter Zoo). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids, thus "lag effects" as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (USFWS and NMFS 1992).

The largest contributors to the decline of Kemp's ridleys in the past were commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the GOM trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches has allowed the species to begin to rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

5.4 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size of adult leatherbacks and their tolerance to relatively low temperatures allows them to occur in northern waters such as off Labrador and in the Barents Sea (NMFS and USFWS 1995). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations to and from their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). That number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, the global population of adult females had declined to 34,500 (Spotila et al. 1996). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996), and felt they may be somewhat low, because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. However, Spotila et al. (1996) represents the best overall estimate of adult female leatherback population size.

5.4.1 Pacific Ocean

Based on published estimates of nesting female abundance, leatherback populations have collapsed or have been declining at all major Pacific basin nesting beaches for the last two decades (Spotila et al. 1996, NMFS and USFWS 1998, Sarti et al. 2000, Spotila et al. 2000). For example, the nesting assemblage on Terengganu, Malaysia – which was one of the most significant nesting sites in the western Pacific Ocean – has declined severely from an estimated 3,103 females in 1968 to two nesting females in 1994 (Chan and Liew 1996). Nesting assemblages of leatherback turtles are in decline along the coasts of the Solomon Islands, a historically important nesting area (D. Broderick, pers. comm., in Dutton et al. 1999). In Fiji, Thailand, Australia, and Papua New Guinea (East Papua), leatherback turtles have only been known to nest in low densities and scattered colonies.

Only an Indonesian nesting assemblage has remained relatively abundant in the Pacific basin. The largest extant leatherback nesting assemblage in the Indo-Pacific lies on the north Vogelkop coast of Irian Jaya (West Papua), Indonesia, with over 3,000 nests recorded annually (Putrawidjaja 2000, Suarez et al. 2000). During the early-to-mid 1980s, the number of female leatherback turtles nesting on the two primary beaches of Irian Jaya appeared to be stable. More recently, this population has come under increasing threats that could cause this population to experience a collapse that is similar to what occurred at Terengganu, Malaysia. In 1999, for example, local Indonesian villagers started reporting dramatic declines in sea turtle populations near their villages (Suarez 1999). Unless hatchling and adult turtles on nesting beaches receive more protection, this population will continue to decline. Declines in nesting assemblages of leatherback turtles have been reported throughout the western Pacific region, with nesting assemblages well below abundance levels observed several decades ago (e.g., Suarez 1999).

In the western Pacific Ocean and South China Seas, leatherback turtles are captured, injured, or killed in numerous fisheries, including Japanese longline fisheries. The poaching of eggs, killing of nesting females, human encroachment on nesting beaches, beach erosion, and egg predation by animals also threaten leatherback turtles in the western Pacific.

In the eastern Pacific Ocean, nesting populations of leatherback turtles are declining along the Pacific coast of Mexico and Costa Rica. According to reports from the late 1970s and early 1980s, three beaches on the Pacific coast of Mexico supported as many as half of all leatherback turtle nests for the eastern Pacific. Since the early 1980s, the eastern Pacific Mexican population of adult female leatherback turtles has declined to slightly more than 200 individuals during 1998-99 and 1999-2000 (Sarti et al. 2000). Spotila et al. (2000) reported the decline of the leatherback turtle population at Playa Grande, Costa Rica, which had been the fourth largest nesting colony in the world. Between 1988 and 1999, the nesting colony declined from 1,367 to 117 female leatherback turtles. Based on their models, Spotila et al. (2000) estimated that the colony could fall to less than 50 females by 2003-2004. Leatherback turtles in the eastern Pacific Ocean are captured, injured, or killed in commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru, and purse seine fisheries for tuna in the eastern tropical Pacific Ocean, and California/Oregon drift gillnet fisheries. Because of the limited data, we cannot provide high-certainty estimates of the number of leatherback turtles captured, injured, or killed through interactions with these fisheries. However, between 8-17 leatherback turtles were estimated to have died annually between 1990 and 2000 in interactions with the California/Oregon drift gillnet fishery; 500 leatherback turtles are estimated to die annually in Chilean and Peruvian fisheries; 200 leatherback turtles are estimated to die in direct harvests in Indonesia; and before 1992, the North Pacific driftnet fisheries for squid, tuna, and billfish captured an estimated 1,000 leatherback turtles each year, killing about 111 of them each year.

Although all causes of the declines in leatherback turtle colonies in the eastern Pacific have not been documented, Sarti et al. (1998) suggest that the declines result from egg poaching, adult and sub-adult mortalities incidental to high seas fisheries, and natural fluctuations due to changing environmental conditions. Some published reports support this suggestion. Sarti et al. (2000) reported that female leatherback turtles have been killed for meat on nesting beaches like Píedra de Tiacoyunque, Guerrero, Mexico. Eckert (1997) reported that swordfish gillnet fisheries in Peru and Chile contributed to the decline of leatherback turtles in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico, occurred at the same time that effort doubled in the Chilean driftnet fishery. In response to these effects, the eastern Pacific population has continued to decline, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (e.g., Spotila et al. 1996, Spotila et al. 2000). The NMFS assessment of three nesting aggregations in its February 23, 2004, biological opinion supports this conclusion: If no action is taken to reverse their decline, leatherback sea turtles nesting in the Pacific Ocean either have high risks of extinction in a single human generation (for example, nesting aggregations at Terrenganu and Costa Rica) or they have a high risk of declining to levels where more precipitous declines become almost certain (e.g., Irian Jaya) (NMFS 2004a).

5.4.2 Atlantic Ocean

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS 2001). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NMFS 2001). Genetic analyses of leatherbacks to date indicate that within the Atlantic basin there are genetically different nesting populations; the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1999). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the *Sargassum* areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (Eckert et al. 1999, Hayes et al. 2004).

Life History and Distribution

Leatherbacks are a long-lived species, living for over 30 years. They reach sexual maturity somewhat faster than other sea turtles (except Kemp's ridley), with an estimated range from 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). They nest frequently (up to 10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30 percent) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <145 cm curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 cm ccl.

Although leatherbacks are the most pelagic of the sea turtles, they enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate, and tropical waters (NMFS and USFWS 1992). A 1979 aerial survey of the outer continental shelf from Cape Hatteras, North Carolina, to Cape Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in waters where depths ranged from 1-4,151 m, but 84.4 percent of sightings were in areas where the water was less than 180 m deep (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as loggerheads; from 7-27.2°C (Shoop and Kenney 1992). However, this species appears to have a greater tolerance for colder waters because more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). This aerial survey estimated the in-water leatherback population from near Nova Scotia, Canada to Cape Hatteras, North Carolina at approximately 300-600 animals.

Population Dynamics and Status

The status of the Atlantic leatherback population is less clear than the Pacific population. The total Atlantic population size is undoubtedly larger than in the Pacific, but overall population trends are unclear. In 1996, the entire western Atlantic population was characterized as stable at best (Spotila et al. 1996), with numbers of nesting females reported to be on the order of 18,800. A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females. The nesting aggregation in French Guiana has been declining at about 15 percent per year since 1987 (NMFS 2001). However, from 1979-1986, the number of nests was increasing at about 15 percent annually which could mean that the current 15 percent decline could be part of a nesting cycle which coincides with the erosion cycle of Guiana beaches described by Schultz (1975). In Suriname, leatherback nest numbers have shown large recent increases (with more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001), and the long-term trend for the overall Suriname and French Guiana population may show an increase (Girondot 2002 in Hilterman and Goverse 2003). The number of nests in Florida and the U.S. Caribbean has been increasing at about 10.3 percent and 7.5 percent, respectively, per year since the early 1980s, but the magnitude of nesting is much smaller than that along the French Guiana coast (NMFS 2001). Also, because leatherback females can lay 10 nests per season, the recent increases to 400 nests per year in Florida may represent as few as 40 individual female nesters per year.

In summary, the conflicting information regarding the status of Atlantic leatherbacks makes it difficult to characterize the current status. Numbers at some nesting sites are increasing, but are decreasing at other sites. Tag return data emphasize the wide-ranging nature of the leatherback and the link between South American nesters and animals found in U.S. waters. For example, a nesting female tagged May 29, 1990, in French Guiana was later recovered and released alive from the York River, Virginia. Another nester tagged in French Guiana on June 21, 1990, was later found dead in Palm Beach, Florida (STSSN database). Genetic studies performed within the Northeast Distant Fishery Experiment indicate that the leatherbacks captured in the Atlantic highly migratory species pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95 percent). Individuals from West African stocks were surprisingly absent.

There are a number of problems contributing to the uncertainty of the leatherback nest counts and population assessments. The nesting beaches of the Guianas (Guyana, French Guiana, and Suriname) and Trinidad are by far the most important in the western Atlantic. However, beaches in this region undergo cycles of erosion and reformation, so that the nesting beaches are not consistent over time. Additionally, leatherback sea turtles do not exhibit the same degree of nest-site fidelity demonstrated by loggerhead and other hardshell sea turtles, further confounding analysis of population trends using nesting data. Reported declines in one country and reported increases in another may be the result of migration and beach changes, not true population changes. Nesting surveys, as well as being hampered by the inconsistency of the nesting beaches, are themselves inconsistent throughout the region. Survey effort varies widely in the seasonal coverage, aerial coverage, and actual surveyed sites. Surveys have not been conducted consistently throughout time, or have even been dropped entirely as the result of wars, political turmoil, funding vagaries, etc. The methods vary in assessing total numbers of nests and total numbers of females. Many sea turtle scientists agree that the Guianas (and some would include Trinidad) should be viewed as one population and that a synoptic evaluation of nesting at all beaches in the region is necessary to develop a true picture of population status (Reichart et al. 2001). No such region-wide assessment has been conducted recently.

The most recent, complete estimates of regional leatherback populations are in Spotila et al. (1996). As discussed above, nesting in the Guianas may have been declining in the late 1990s but may have increased again in the early 2000s. Spotila et al. estimated that the leatherback population for the Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa totaled approximately 27,600 nesting females, with an estimated range of 20,082-35,133. We believe that the current population probably still lies within this range, taking into account the reported nesting declines and increases and the uncertainty surrounding them. We therefore choose to rely on Spotila et al.'s (1996) published total Atlantic population estimates, rather than attempt to construct a new population estimate here, based on our interpretation of the various, confusing nesting reports from areas within the region.

Threats

Zug and Parham (1996) pointed out that the main threat to leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches.

Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Of sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, possibly their method of locomotion, and perhaps their attraction to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets and pot/trap lines (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not usually ingest longline bait. Instead, leatherbacks are foul hooked by longline gear (e.g., on the flipper or shoulder area) rather than getting mouth hooked or swallowing the hook (NMFS 2001). According to observer records, an estimated 6,363 leatherback sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992-1999, of which 88 were released dead (NMFS 2001). The U.S. fleet accounts for only 5 to 8 percent of the hooks fished in the Atlantic Ocean, and adding up the under-represented observed takes of the other 23 countries that actively fish in the area would lead to annual take estimates of thousands of leatherbacks over different life stages. Basin-wide, Lewison et al. (2004) estimated that 30,000-60,000 leatherback sea turtle captures occurred in Atlantic pelagic longline fisheries in the year 2000 alone (note that multiple captures of the same individual are known to occur, so the actual number of individuals captured may not be as high).

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al. 2002). Fixed gear fisheries in the mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly in NMFS 2001). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill in NMFS SEFSC 2001). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the southeast Atlantic shrimp fishery, which operates predominately from North Carolina through southeast Florida (NMFS 2002), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida, to the Virginia/North Carolina border. Leatherbacks also interact with the GOM shrimp fishery. For many years, TEDs required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles.

Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Science Center observer documented the take of a leatherback in a bottom otter trawl fishing for Loligo squid off of Delaware; TEDs are not required in this fishery. The winter trawl flounder fishery, which did not come under the revised TED regulations, may also interact with leatherback sea turtles.

Gillnet fisheries operating in the nearshore waters of the mid-Atlantic states are also suspected of capturing, injuring, and/or killing leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994 through 1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54 to 92 percent.

Poaching is not known to be a problem for nesting populations in the continental U.S. However, in 2001 the NMFS Southeast Fishery Science Center (SEFSC) noted that poaching of juveniles and adults was still occurring in the U.S. Virgin Islands and the Guianas. In all, four of the five strandings in St. Croix were the result of poaching (Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching is on eggs.

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997, Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44 percent of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13 percent) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object might resemble a food item by its shape, color, size or even movement as it drifts about, and induce a feeding response in leatherbacks.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations that participate in Atlantic pelagic longline fisheries, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (see NMFS SEFSC 2001, for a description of take records). Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo et al. 1994, Graff 1995). Gillnets are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier et al. 1999), and gillnets targeting green and hawksbill turtles in the waters of coastal Nicaragua also incidentally catch leatherback turtles (Lagueux et al. 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50 to 95 percent (Eckert and Lien 1999). However, many of the turtles do not die as a result of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NMFS 2001).

5.4.3 Summary of Leatherback Status

In the Pacific Ocean, the abundance of leatherback turtle nesting individuals and colonies has declined dramatically over the past 10 to 20 years. Nesting colonies throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females. In addition, egg poaching has reduced the reproductive success of the remaining nesting females. At current rates of decline, leatherback turtles in the Pacific basin are a critically endangered species with a low probability of surviving and recovering in the wild.

In the Atlantic Ocean, our understanding of the status and trends of leatherback turtles is much more confounded, although the picture does not appear nearly as bleak as in the Pacific. The number of female leatherbacks reported at some nesting sites in the Atlantic Ocean has increased, while at others they have decreased. Some of the same factors that led to precipitous declines of leatherbacks in the Pacific also affect leatherbacks in the Atlantic: leatherbacks are captured and killed in many kinds of fishing gear and interact with fisheries in state, federal, and international waters. Poaching is a problem and affects leatherbacks that occur in U.S. waters. Leatherbacks also appear to be more susceptible to death or injury from ingesting marine debris than other turtle species.

5.5 Sperm Whale

Distribution

The sperm whale is the largest of the toothed whales, reaching a length of 18.3 meters in males and 12.2 meters in females (Odell 1992). Sperm whales are distributed in all of the world's seas and oceans. For the purposes of management, the International Whaling Commission (IWC) defines four stocks: the North Pacific, the North Atlantic, the Northern Indian Ocean, and Southern Hemisphere. However, Dufault et al.'s (1999) review of the current knowledge of sperm whales indicates no clear picture of the worldwide stock structure of sperm whales.

In general, females and immature sperm whales appear to be restricted in range, whereas males are found over a wider range and appear to make occasional movements across and between ocean basins (Dufault et al. 1999). Females and juveniles form pods that are generally within tropical and temperate latitudes between 50°N and 50°S, while the solitary adult males can be found at higher latitudes between 75°N and 75°S (Reeves and Whitehead 1997). The home ranges of individual females seem to span distances of approximately 1,000 km (Best 1979, Dufault and Whitehead 1995). However, occasionally females travel several thousand kilometers across large parts of an ocean basin (Kasuya and Miyashita 1988). In the western North Atlantic they range from Greenland to the GOM and the Caribbean.

Sperm whales generally occur in waters greater than 180 meters in depth. While they may be encountered almost anywhere on the high seas, their distribution shows a preference for continental margins, sea mounts, and areas of upwelling, where food is abundant. Waring et al. (1993) suggest sperm whale distribution in the Atlantic is closely correlated with the Gulf Stream edge. Bull sperm whales migrate much farther poleward than the cows, calves, and young males. Because most of the breeding herds are confined almost exclusively to warmer waters, many of the larger mature males return in the winter to the lower latitudes to breed.

Life history

Female sperm whales attain sexual maturity at the mean age of 8 or 9 years and a length of about 9 m (Kasuya 1991, see Würsig et al. 2000). The mature females ovulate April through August in the Northern Hemisphere. During this season one or more large mature bulls temporarily join each breeding school. A single calf is born at a length of about 4 m, after a 15 to 16 month gestation period. Sperm whales exhibit alloparental (the assistance by individuals other than the parents in the care of offspring) guarding of young at the surface (Whitehead 1996), and alloparental nursing (Reeves and Whitehead 1997). Calves are nursed for 2 to 3 years (in some cases, up to 13 years); and the calving interval is estimated to be about 4 to 7 years (Kasuya 1991, see Würsig et al. 2000).

Males have a prolonged puberty and attain sexual maturity at between age 12 and 20, and a body length of 12 m, but may require another 10 years to become large enough to successfully compete for breeding rights (Kasuya 1991, see Würsig et al. 2000). Bachelor schools consist of maturing males who leave the breeding school and aggregate in loose groups of about 40 animals. As the males grow older they separate from the bachelor schools and remain solitary most of the year (Best 1979).

The age distribution of the sperm whale population is unknown, but they are believed to live at least 60 years. Potential sources of natural mortality in sperm whales include killer whales and the papilloma virus (Lambertsen et al. 1987).

Cephalopods (i.e., squid, octopi, cuttlefishes, and nautili) are the main dietary component of sperm whales. The ommastrephids, onychoteuthids, cranchids, and enoploteuthids are the cephalopod families that are numerically important in the diet of sperm whales in the GOM (Davis et al. 2002). Other populations are known to also take significant quantities of large demersal and mesopelagic sharks, skates, and bony fishes, especially mature males in higher latitudes (Clarke 1962, 1979). Postulated feeding and hunting methods include lying suspended and relatively motionless near the ocean floor and ambushing prey; attracting squid and other prey with bioluminescent mouths; or stunning prey with ultrasonic sounds (Norris and Mohl 1983, and Berzin 1971, as cited in Würsig et al. 2000). Sperm whales occasionally drown after becoming entangled in deep-sea cables that wrap around their lower jaw, and non-food objects have been found in their stomachs, suggesting these animals may at times cruise the ocean floor with open mouths (Würsig et al. 2000, Rice 1989).

Diving and social behavior

Sperm whales are noted for their ability to make prolonged, deep dives, and are likely the deepest and longest diving mammal. Typical foraging dives last 40 minutes and descend to about 400 m, followed by approximately 8 minutes of resting at the surface (Gordon 1987, Papastavrou et al. 1989). However, dives of over 2 hours and deeper than 3.3 km have been recorded (Clarke 1976) and individuals may spend extended periods of time at the surface to recover. Descent rates recorded from echo-sounders were approximately 1.7 m/sec and nearly vertical (Goold and Jones 1995). There are no data on diurnal differences in dive depths in sperm whales. Dive depth may be dependent upon temporal variations in prey abundance.

Vocalizations and hearing

Evidence suggests that the disproportionately large head of the sperm whale is an adaptation to produce acoustic signals (Norris and Harvey 1972, Cranford 1992). This suggests that vocalizations are extremely important to sperm whales. The function of vocalizations is relatively well-studied (Weilgart and Whitehead 1997, Goold and Jones 1995). Long series of monotonous, regularly spaced clicks are associated with feeding and are thought to be produced for echolocation. Sperm whales also utilize unique stereotyped click sequence "codas" (Mullins et al. 1988, Watkins 1977, Adler-Fenchel 1980, Watkins et al. 1985), according to Weilgart and Whitehead (1988) to possibly convey information about the age, sex, and reproductive status of the sender. Groups of closely related females and their offspring have group-specific dialects (Weilgart and Whitehead 1997).

Population status and trend

The primary factor for the population decline that precipitated ESA listing was commercial whaling in the 18th, 19th, and 20th centuries for ambergris and spermaceti. The IWC estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900. From 1910 to 1982, there were nearly 700,000 sperm whales killed worldwide from whaling activities (IWC Statistics 1959-1983). Sperm whales have been protected from commercial harvest by the IWC since 1981, although the Japanese continued to harvest sperm whales in the North Pacific until

1988 (Reeves and Whitehead 1997). Since the ban on nearly all hunting of sperm whales, there has been little evidence that direct effects of anthropogenic causes of mortality or injury are significantly affecting the recovery of sperm whale stocks (Perry et al. 1999, Waring et al. 2002), yet the effects of these activities on the behavior of sperm whales has just recently begun to be studied. Presently, the global population of sperm whales is estimated to be at 32 percent of its pre-whaling number (Whitehead 2002).

Impacts of human activities

Documented takes of sperm whales primarily involve offshore fisheries such as the offshore lobster pot fishery and pelagic driftnet and longline fisheries. Sperm whales have learned to depredate sablefish from longline gear in the Gulf of Alaska and toothfish from longline operations in the South Atlantic Ocean. No direct injury or mortality has been recorded during hauling operations, but lines have had to be cut when whales were caught on them (Ashford et al. 1996). Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are less subject to entanglement than are right or humpback whales. Sperm whales have been taken in the pelagic drift gillnet fishery for swordfish, and could likewise be taken in the shark drift gillnet fishery on occasions when they may occur more nearshore, although this likely does not occur often. Although no interaction between sperm whales and the longline fishery have been recorded in the U.S. Atlantic, as noted above, such interactions have been documented elsewhere. The Southeast U.S. Marine Mammal Stranding Network received reports of 16 sperm whales that stranded along the GOM coastline from 1987 to 2001 in areas ranging from Pinellas County, Florida to Matagorda County, Texas. One of these whales had deep, parallel cuts posterior to the dorsal ridge that were believed to be caused by the propeller of a large vessel; this trauma was assumed to be the proximate cause of the stranding. Due to the offshore distribution of this species, interactions that do occur are less likely to be reported than those involving right, humpback, and fin whales occurring in nearshore areas.

5.6 Gulf Sturgeon

NMS and the FWS listed the Gulf sturgeon, also known as the GOM sturgeon, as a threatened species on September 30, 1991 (56 CFR 49653). The present range of the Gulf sturgeon extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida. Sporadic occurrences have been recorded as far west as the Rio Grande River between Texas and Mexico, and as far east and south as Florida Bay (Wooley and Crateau 1985, Reynolds 1993).

Life history

The Gulf sturgeon is an anadromous fish; adults spawn in freshwater then migrate to feed and grow in estuarine/marine habitats. After spawning in the upper river reaches, both adult and subadult Gulf sturgeon migrate from the estuaries, bays, and the GOM to the coastal rivers in early spring (i.e., March through May) when river water temperatures range from 16 to 23°C (Huff 1975, Carr 1983, Wooley and Crateau 1985, Odenkirk 1989, Clugston et al. 1995, Foster and Clugston 1997, Fox and Hightower 1998, Sulak and Clugston 1999, Fox et al. 2000). Fall downstream migration from the river into the estuary/GOM begins in September (at water temperatures around 23°C) and continues through November (Huff 1975, Wooley and Crateau 1985, Foster and Clugston 1997).

Most subadult and adult Gulf sturgeon spend cool months (October or November through March or April) in estuarine areas, bays, or in the GOM (Odenkirk 1989, Foster 1993, Clugston et al. 1995, and Fox et al. 2002). Research indicates that in the estuary/marine environment both subadult and adult Gulf sturgeon show a preference for sandy shoreline habitats with water depths less than 3.5 m and salinity less than 6.3 parts per thousand (Fox and Hightower 1998). The majority of tagged fish have been located in areas lacking seagrass (Fox et al. 2002), in shallow shoals 1.5 to 2.1 m and deep holes near passes (Craft et al. 2001), and in unvegetated, fine to medium-grain sand habitats, such as sandbars, and intertidal and subtidal energy zones (Menzel 1971, Abele and Kim 1986). These shifting, predominantly sandy, areas support a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, ghost shrimp, small crabs, various polychaete worms, and lancelets (Menzel 1971, Abele and Kim 1986, AFS 1989, and M. Brim, USFWS pers. comm. 2002).

Once subadult and adult Gulf sturgeon migrate from the river to the estuarine/marine environment, having spent at least 6 months in the river fasting, it is presumed that they immediately begin foraging. Upon exiting the rivers, Gulf sturgeon are found in high concentrations near their natal river mouths; these lakes and bays at the mouth of the river are important because they offer the first opportunity for Gulf sturgeon to forage. Specifics regarding Gulf sturgeon diet items and foraging are discussed within Section IV (Effects of the Action) of this biological opinion.

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years in age (Huff 1975). Age at sexual maturity for females ranges from 8 to 17 years, and for males from 7 to 21 years (Huff 1975). Chapman et al. (1993) estimated that mature female Gulf sturgeon weighing between 29 and 51 kg produce an average of 400,000 eggs.

Based on the fact that male Gulf sturgeon are capable of annual spawning, and females require more than one year between spawning events (Huff 1975, Fox et al. 2000), we assume that the Gulf sturgeon are similar to Atlantic sturgeon (*A. o. oxyrhinchus*); that is, they exhibit a long inter-spawning period, with females spawning at intervals ranging from every 3 to 5 years, and males every 1 to 5 years (Smith 1985). Spawning occurs in the upper river reaches in the spring when water temperature is around 15° to 20°C. While Sulak and Clugston (1999) suggested that sturgeon spawning activity is related to moon phase, other researchers have found little evidence of spawning associated with lunar cycles (Slack et al. 1999, Fox et al. 2000). Fertilization is external; females deposit their eggs on the river bottom and males fertilize them. Gulf sturgeon eggs are demersal, adhesive, and vary in color from gray to brown to black (Vladykov and Greeley 1963, Huff 1975, Parauka et al. 1991).

Genetic studies conclude that Gulf sturgeon exhibit river-specific fidelity. Stabile et al. (1996) analyzed tissue taken from Gulf sturgeon in eight drainages along the GOM for genetic diversity; they noted significant differences among Gulf sturgeon stocks, and suggested region-specific affinities and likely river-specific fidelity. Five regional or river-specific stocks (from west to east) have been identified: (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow Rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee Rivers (Stabile et al. 1996).

Tagging studies also indicate that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983). Of 4,100 fish tagged, 21 percent (860/4100 fish) were later recaptured in the river of their initial collection, eight fish (0.009 percent) moved between river systems, and the remaining fish (78 percent) have not yet been recaptured (USFWS et al. 1995). There is no information documenting the presence of spawning adults in non-natal rivers. However, there is some evidence of inter-riverine (from natal rivers into non-natal) movements by both male and female Gulf sturgeon (n=22) (Wooley and Crateau 1985, Carr et al. 1996, Craft et al. 2001, Ross et al. 2001b, Fox et al. 2002). It is important to note that gene flow is low in Gulf sturgeon stocks, with each stock exchanging less than one mature female per generation (Waldman and Wirgin 1998).

A full discussion of the life history of this subspecies may be found in the September 30, 1991, final rule listing the Gulf sturgeon as a threatened species (56 FR 49653), the Recovery/Management Plan approved by NMFS and the U.S. Fish and Wildlife Service in September 1995, and the final rule designating Gulf sturgeon critical habitat (68 FR 13370).

Population dynamics and status
Gulf sturgeon occur in most major tributaries of the northeastern GOM, from the Mississippi River east to Florida's Suwannee River, and in the central and eastern nearshore Gulf waters as far south as Charlotte Harbor (Wooley and Crateau 1985). In Florida, Gulf sturgeon are present in the Escambia, Yellow, Blackwater, Choctawhatchee, Apalachicola, Ochlockonee, and Suwannee Rivers (Reynolds 1993). While little is known about the abundance of Gulf sturgeon throughout most of its range, population estimates have been calculated for the Apalachicola, Choctawhatchee, and Suwannee Rivers. The USFWS calculated an average (from 1984-1993) of 115 individuals (> 45 cm TL) over-summering in the Apalachicola River below Jim Woodruff Lock and Dam (USFWS et al. 1995). Preliminary estimates of the Gulf sturgeon subpopulation in the Choctawhatchee River system are 2,000 to 3,000 fish over 61 cm TL. The Suwannee River Gulf sturgeon population (i.e., fish > 60 cm TL and older than age 2) has recently been calculated at approximately 7,650 individuals (Sulak and Clugston 1999). Although the size of the Suwannee River population is considered stable, the population structure is highly dynamic as indicated by length frequency histograms (Sulak and Clugston 1999). Strong and weak year classes coupled with the regular removal of larger fish (by natural mortality) limits the growth of the Suwannee River population but stabilizes the average population size (Sulak and Clugston 1999).

6 ENVIRONMENTAL BASELINE

This section contains a description of the effects of past and ongoing human activities leading to the current status of the species, their habitat, and the ecosystem, within the